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Japan's Value Added Market: Wood Product Attributes and Competition

Linkage Analysis

Prepared for and with financial assistance from

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Abstract

This report presents a "linkage analysis" of how wood product and system attributes demanded in Japan can be met by the British Columbia, and to a lessor extent, the Canadian forest products industries

In 1998 an extensive market research effort in Japan was performed by Forintek Canada Corp. The study identified the wood product attributes demanded by Japanese builders, pre-cutters, architects, and consumers across both the primary and secondary wood products sectors.

Concurrent with the attribute analysis, a trade flow model was developed. This portion of the study has produced an important tool in assessing the competitive situation in exporting wood products to Japan in the face of global competition. The results of this study have been reported in a series of product category specific reports, as well as two reports on the competitor analysis.

The goal of the linkage analysis is to match the attributes demanded in Japan to the attributes that can be *competitively* supplied by the British Columbia/Canada industry. The main products or product groups that are discussed as showing strong potential for continues success and growth are:

Building Systems
- Hybrid structures
- Performance of structures (seismic)
- Healthy house
- Changes in the Building Standards Laws
- Government promotion of :
    - Lower cost construction
    - Imported housing
    - Increased per capita floor area
    - Seniors' housing
- Multi-family wood structures in suburban areas

Wood Structural Members
- Move to pre-cut post and beam, requiring kiln dried wood components, creating post & beam house opportunities for
    - Lamstock
    - Premium Solid SPF Member
    - Dry Solid Hemlock Structural Member, as Well as Other BC Coastal Species
- Generally, opportunities for
    - Borate Treated Lumber
    - Increased J-Grade exports with continued expansion of platform frame home construction

Engineered Structural Members
- Increased demand for glulam, driven by the move to pre-cut wood components for post & beam homes (a less expensive alternative to large dimension solid kiln dried wood); performance connotations of glulam

- Specific opportunities for
  - Borate Treated Glulam
  - Borate Treated Lamstock
  - Bark Board Sill Plates (Dodai)
  - Hemlock LVL

Wood Furniture

- Growing demand for lighter colours and North American styles have created opportunities for Canadian softwood furniture in addition to hardwood
- Opportunity for value-added; style and durability drive demand, NOT price

Interior Finish

- As with furniture, a strong trend to light colours, creating opportunities for Canadian softwoods
  - Largest demand for floors, followed by stair parts and doors, wainscot and windows
  - Wood floor demand strengthening in Japan with "healthy house"; however, solid wood flooring still have a small market share in Japan

Outdoor Furnishings and Decking

- There is a strong trend in Japan to incorporate "outdoor living" into their lifestyles, something that has not existed in the past

- Excellent opportunity for BC western red cedar, both in lumber and in systems/matching components (including decking, fencing, and outdoor furniture)

Acknowledgements

The authors wish to express their sincere appreciation for the members of the steering committee for this project, for Forintek Canada Corp. scientists, and for identified wood products experts for their input into this study.

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1 Objectives

This report presents an analysis of how wood product and system attributes demanded in Japan can be met by the British Columbia, and to a lessor extent, the Canadian forest products industry. It details the linkage analysis results for the six product segments studied and reported in the attribute analysis reported in Cohen and Gaston (1998).

In 1998 an extensive market research effort in Japan was performed by Forintek Canada Corp. The study identified the wood product attributes demanded by Japanese builders, pre-cutters, architects, and consumers across both the primary and secondary wood products sectors.

Concurrent with the attribute analysis, a trade flow model was developed. This portion of the study has produced an important tool in assessing the competitive situation in exporting wood products to Japan in the face of global competition. The results of this study have been reported in a series of product category specific reports (Table 1).

Table 1 Reports Available from the Japan Attribute/Competition Study

Japan's Value Added Market: Wood Product Attributes and Competition
1. Attribute Analysis: Methodology
2. Attribute Analysis: Wood Structural Members
3. Attribute Analysis: Engineered Structural Members
4. Attribute Analysis: Building Systems
5. Attribute Analysis: Wood Furniture
6. Attribute Analysis: Outdoor Furnishings & Decking
7. Attribute Analysis: Interior Finish
8. Competitor Analysis One
9. Competitor Analysis Two
10. LINKAGE ANALYSIS
11. Executive Summary: "Trends in the Japanese Wood Market" (in print)

The attribute and the competitor analyses have produced a considerable volume of knowledge. However, it is when these results are viewed in relation to each other and the British Columbia/Canada industry that the full potential of this study is recognised. This has led to the linkage analysis reported here.

The goal of the linkage analysis is to match the attributes demanded in Japan to the attributes that can be *competitively* supplied by the British Columbia/Canada industry. It is through Forintek scientists and industry members that the triad in Figure 1 is completed.

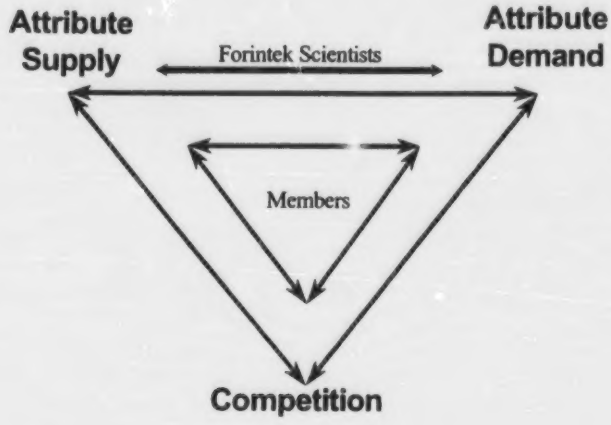


Figure 1 ***Competitive Linking of Supply and Demand***

The linkage analysis relied heavily on these industry experts to identify opportunities where the attributes demanded in Japan and could be supplied by specific BC/Canada products or systems. Once identified these products or systems are assessed using a series of feasibility criteria. The final feasibility test is the competitiveness of the product or system in a dynamic world market.

The outcome of this analysis is a series of product and system opportunities and a preliminary evaluation of the technical and market feasibility of each.

2 Methods

2.1 Attribute Analysis

The goal of the attribute analysis was to study wood products and system preferences in Japan. Research was conducted across six product groups that represented both primary and secondary wood products. Data was collected through interviews with small builders, pre-cutters, designers, and consumers. For each product group the appropriate specifiers were interviewed. In total there were 170 small builders, 130pre-cutters, 225 consumers and 50 designers interviewed.

Table 2 Product Groups and Interview Groups

Product Group	Types of People Interviewed
Building systems	Small builders & consumers
Engineered structural products	Small builders & pre-cutters
Wood structural members	Small builders & pre-cutters
Wood for interior finish	Small builders & designers & consumers
Wood furniture	Consumers & designers
Outdoor furnishings & decking	Consumers

The methodology used in the attribute analysis was an application of conjoint analysis. This type of analysis asks specifiers to choose among products supplying differing levels of a set of attributes. This forces respondents to make tradeoffs in there choices. Through analysis of several sets of choices the conjoint analysis software is able to understand the tradeoffs made and predict the effect of altering attribute levels. Table 3 gives an example of a choice matrix. The advantage to this type of analysis is that respondents must consider all attributes at the same time. Therefore, the relative importance of each attribute level can be understood.

Table 3 Example Conjoint "Choice Matrix"

Example Choices for Building Systems		
1	2	3
• 2 story detached	• 3 story detached	• apartment
• 500,000¥ /tsubo	• 400,000 ¥ /tsubo	• 300,000 ¥ /tsubo
• wood from local retailer	• wood from local wholesaler	• wood from local retailer
• Japanese wood	• Canadian wood	• European wood
• post and beam	• Hybrid	• 2x4
• last 40 years	• last 20 years	• last 50 years

In addition to the conjoint analysis choice questions, respondents were also asked to respond to a series of survey questions. These questions collected data on demographics as well as more specific information on wood use.

The results of the attribute analysis are written up in a series of seven reports (Table 1). One report covers the methodology of the study, and the other six provide specific results for each of the product groups.

These reports are available from Forintek Canada Corp. by contacting:

Phyllis Fraser
Publications
Western Division Library
Vancouver, B.C.
Tel. (604) 222-5743
Fax. (604) 222-5690
Email *phyllis@van.forintek.ca*

2.2 Competitor Analysis

The methodology used for the competitor analysis was three-fold:

1. Document the current global supply and demand picture for softwood, with particular emphasis on BC/Canada as a producer, and Japan as a consumer;
2. document global trade of softwood products, offering time trends in both volume and unit values, for both major exporters and importers, with as much attention to product detail as possible; to reconcile trade statistics between exporting and corresponding importing countries;
3. develop and utilize a global trade model for the purpose of analysing competitive position of BC/Canadian products in Japan against competing suppliers.

The use of a trade model for the competitor analysis was in recognition that competitive positioning of BC/Canadian products in Japan is highly dynamic. Wood use can change dramatically over time given changes in such variables as relative production costs, exchange rates, changes in demand in Japan and elsewhere, the introduction of new products or supplying regions, and so on. The global trade model allows for the generation of "what-if" scenarios for alternative future trade-flow outcomes.

The results of the competitor analysis have been written up in two reports (Table 1), and are also available from Forintek Canada Corp. at the above co-ordinates.

2.3 Linkage Analysis

2.3.1 Product and System Identification

The goal of the product and system identification is to relate what was learned about the attributes demanded in Japan to the attributes that can be supplied with existing or potential products by the BC/Canada industry. This process involved reviewing the results of the attribute analysis with Forintek Canada Corp. scientists and industry experts (including representatives from member companies, government, university, industry associations) and identifying opportunities where linkages are apparent.

To facilitate this process the results of the attribute analysis were summarised into two product identification packages, primary and secondary wood products. The primary package included attributes for wood structural members, engineered structural members, and building systems. The secondary package included wood for interior finish, wood furniture, and outdoor furniture and decking.

These packages included a short cover letter explaining the linkage analysis, a two page summary of attributes demanded, and a product identification worksheet. On the product identification worksheet respondents are asked to fill in existing products and systems and the Japanese market attributes they fulfil. Respondents were also asked to identify potential products and systems that could be developed to meet Japanese attributes demanded.

Industry experts were then interviewed individually by the linkage facilitators to discuss the products and systems identified on the worksheet. These interviews quite often involved the further discussion of market attribute results. The results from these interviews were refined lists of existing and potential products and systems to take into the evaluation stage.

2.3.2 Product and System Evaluation

Possible products and systems were evaluated by passing them through four sets of feasibility checks. These checks were designed to identify the production, resource, codes and standards, and competitive issues. Product and system evaluation also took place between Forintek Canada Corp. and industry experts.

2.3.2.1 Production Issues

The first feasibility test is production issues. Here the production capabilities, infrastructure, and technology of the BC industry is discussed with respect to the product opportunity. Wherever possible the state of production preparedness is given. In many cases the production capacity for new products already exists. In other cases investment in new equipment or research and development is needed.

2.3.2.2 Resource Issues

The second feasibility hurdle for a new product or system is the fit with the resource. Given the attribute demands of durability, strength, colour, among others, the species which could be used in fabricating the product are identified when possible. This may also include consideration of any differences between old growth and second growth if they will have implications on the product.

2.3.2.3 Design and Performance

The third feasibility test involves the design and performance issues of the product or system in relation to the codes, standards and other market access criteria in Japan (tariff and non-tariff). Structural performance codes and standards or non-legislated performance attributes that the product must meet are identified here. For primary products and building systems these will involve building integrity and seismic considerations. The second design and performance consideration is fire. Fire codes for buildings in Japan are quite complex. The use of wood for structural/non-structural and interior/exterior applications is often restricted due to fire regulations. The final feasibility test under design and

performance is market access. This is a catch-all category for any other tariff or non-tariff barriers associated with design and performance.

When considering design and performance in Japan it is important to discuss the Government Housing Loan Corporation (GHLC). This organisation provides discounted mortgages with the mandate to promote home construction. Over 50% of single-family detached homes are financed through the GHLC. The GHLC can provide different levels of financing depending on a house's conformance with certain initiatives and its use of GHLC approved building materials. Needless to say, for an exporter of wood products it is important to appear on the list of GHLC approved materials.

2.3.2.4 Competitiveness

The final step to product and system evaluation is consideration of competitive issues. This includes an assessment of the current market for the product or system as well as a look to at the trends and possible vulnerabilities of the product in the future.

2.4 Collaborators

The quality of the linkage analysis rests on the depth of knowledge accessed. The analysis began with accessing internal Forintek scientists and industry advisors. This group represents a wide range of knowledge in building systems, secondary products, composite products, lumber manufacturing, and resource (Table 4). Forintek scientists were used for both the identification and the evaluation portions of the linkage analysis.

Table 4 Forintek Canada Corp. Areas of Internal Expertise

Seismic
Codes and Standards
Building Envelopes
Plant Layout
Machinability
Resource Characterisation
Drying
Sawing
Composite panels
Structural composite lumber
Fire
Markets
Economics

The second group of experts consulted in the linkage analysis was the project steering committee (Table 5).

Table 5 Steering Committee

Primary Wood Producers
Secondary Wood Producers
University of British Columbia
Centre for Advanced Wood Processing
BC Wood
Coast Forest and Lumber Association
SPF Working Group

3 Background: Japanese Housing

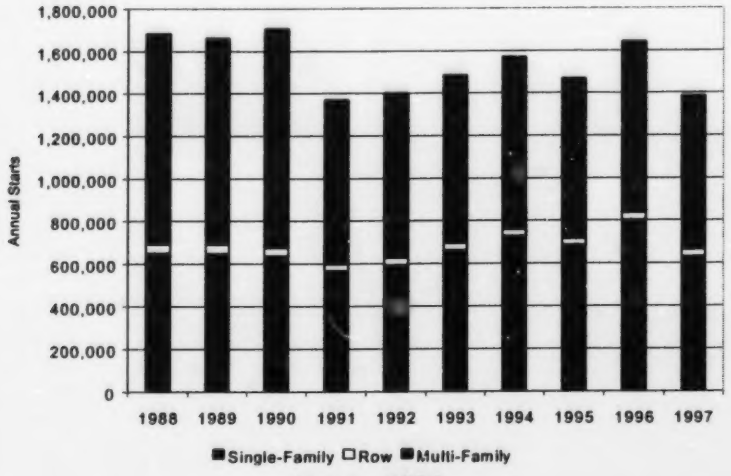
The largest use of softwood in Japan by far is for housing. Any one housing start in Japan can be characterised by dwelling type, construction style, and construction location (Table 6). It is in exploring the combinations possible from this table where opportunities for Canadian wood product suppliers are to be found.

Table 6 Housing Decision Matrix

Dwelling Type	*Construction Style*	*Construction Location*
Single-Family	2x4	On-Site
Multi-Family	Post and Beam	Pre-Cutter
Row House	Hybrid	Pre-fabricator

3.1 Dwelling Type

Japan builds primarily multi-family and single-family dwellings. Of these two types of dwelling annual multi-family starts are usually slightly higher than single-family (Figure 2). However, this is not an accurate indication for the market for wood construction. The majority of multi-family dwellings are made of concrete and steel (Figure 3), while single-family dwellings tend to be constructed of wood.



Source: MOC

Figure 2 Annual Housing Starts

3.1.1 Single-family

The single-family home market in Japan is quite different from what we are accustomed to in North America. The 'second-hand' house market is very small in Japan, largely because land is expensive and tends to stay in the family. Most single-family construction activity is for replacement housing and is not usually associated with a change in land ownership. However, as the average replacement age of a house is less than 25 years, construction activity is high.

Consumers of new single-family houses tend to be in their early to mid 40s. These consumers are usually moving up from a multi-family home in an urban or suburban area. Single-family homes tend to be in suburban areas and quite often the new house will be built to accommodate not only children but parents as well.

3.1.2 Multi-Family

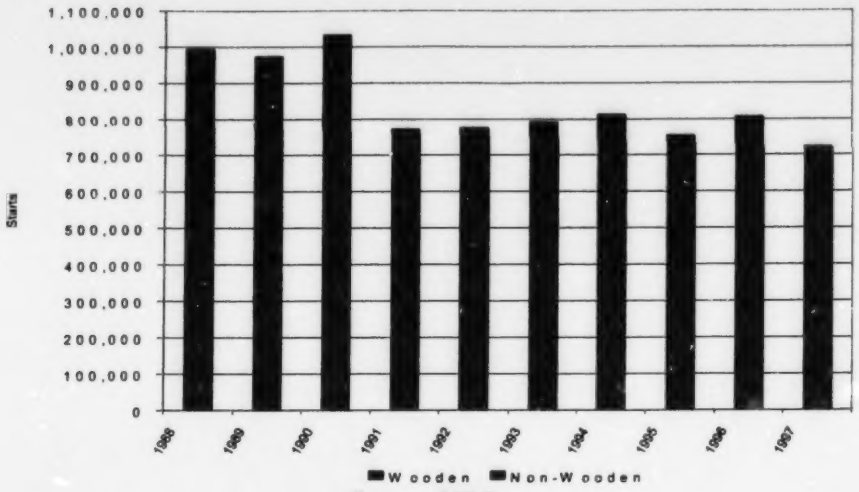
Multi-family dwellings tend to be in urban and suburban areas. The Building Standard Law (BSL) of Japan classifies urban areas as fire protection districts and sub-urban areas as quasi fire protection areas. For this reason the use of wood in multi-family housing is restricted due to combustibility.

Three story multi-family wooden buildings were first allowed in Japan in 1992. The major market opening was not until mid-1997 when these buildings were accepted by the Ministry of Construction (MOC) in quasi fire protection districts. As much as 70% of greater Tokyo is designated a quasi fire protection zone (US Foreign Commercial Service 1998). This underlines the importance of this development for wooden multi-family structures.

Most multi-family wooden structures are built for the rental market (US Foreign Commercial Service 1998). This must be considered when designing these structures. Renters tend to be young professionals who are familiar with North American living.

The 3 story wooden apartment building holds potential for panellised structures and wood imports in general. Adding a third floor allows owners to make greater revenue off their high priced land. Further, these North American style buildings are attractive to the young professional renter demographic.

Wood structures are not common as resident-owned condominiums, but are an important source of rental housing. There is a general belief in the market that wood is less durable than concrete for these structures. Therefore, it is more common to rent than to buy in one of these developments.



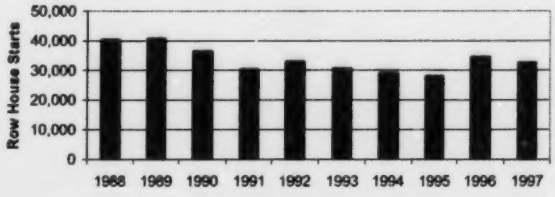
Source: MOC

Figure 3 Annual Multifamily Starts

3.1.3 Row

The Japan Ministry of construction reports in its statistics that row houses have accounted for between 1.8% and 2.5% of annual housing starts in the past 10 years. However, the row houses reported are not all the vertically separated townhouses we are accustomed to in North America. Many of these are low cost company or government housing. These are also produced as rental housing in the suburbs. The North American 'townhouse' type of row houses which are privately owned are not common in Japan. This is mostly because connected row housing requires large lots that are rare in Japan.

With the ageing population in Japan row houses may be a feasible housing solution. Recently the Housing and Urban Development Corporation was given the mandate to purchase large tracts of land securing non-performing loans and redevelop it for affordable housing. This $3.78 billion program may be very suitable for the prospect of row houses for seniors or those with low incomes.

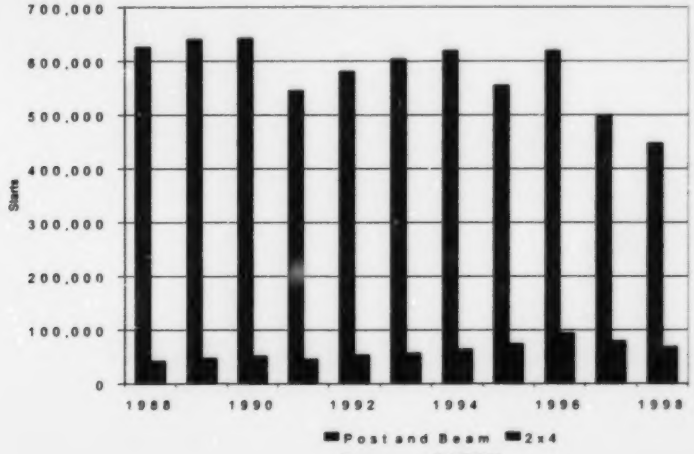


Source: MOC

Figure 4 Annual Row House Starts

3.2 Construction Style

Wood housing starts typically fall within two distinct construction styles in Japan, 2x4 and post and beam. However, the line between these two styles is becoming increasingly blurred, as *hybrids* become more common. Figure 5 displays the breakdown of wood housing starts by construction style.



Source: JAWIC

Figure 5 Japanese Wood Housing Starts

3.2.1 Post and Beam

Post and beam starts make up the majority of wooden single-family housing activity (Figure 5). This construction method uses wood timbers with specially crafted wood joints. Post and beam construction is labour intensive as the notching of joints was typically performed on site by a craftsman. In the past two decades the number of skilled post and beam craftsmen has declined by over one half. The average age of the workforce is projected to increase while the size of the workforce decreases with very few entering the trade in the foreseeable future. This has led to the emergence of pre-cut post and beam factories. This dramatic move to pre-cut components is an important trend that will be returned to many times throughout this report. Figure 6 offers an example.

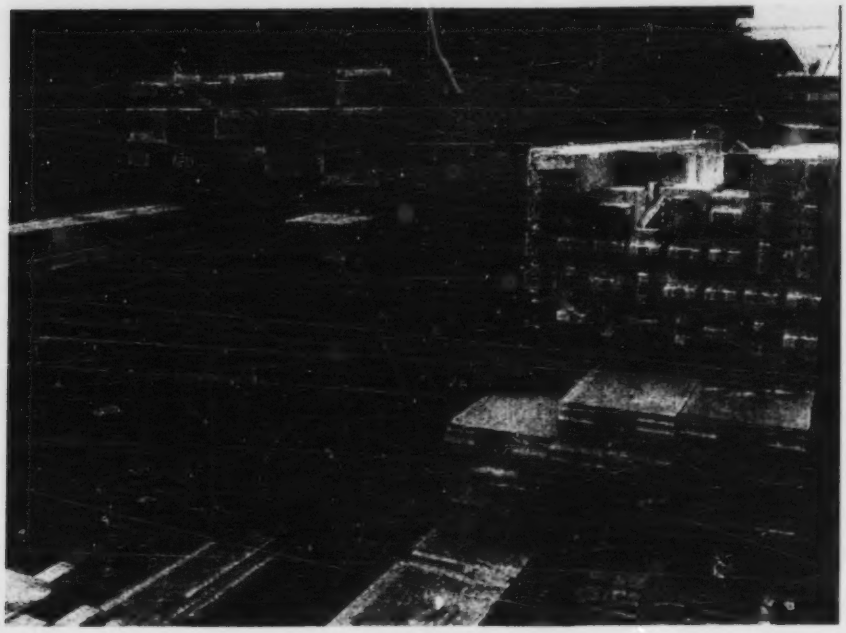


Figure 6 ***Packaged Pre-cut Post and Beam Components***

The post and beam category is often termed "traditional" in literature and statistics. However, within the category of post and beam construction there is a continuum from traditional to modern. More traditional homes are not only traditional in design, but they utilise the on-site notching of a craftsman. They also use traditional solid wood species for construction. On the modern end of the continuum buildings are designed in a more North American style. These modern starts often involve pre-cut wood members of solid or engineered wood.

Post and beam homes make high use of solid and engineered structural wood members. The presence of high quality solid or veneered exposed members is a defining characteristic of this building style. Good opportunities exist for Canadian producers to continue to serve this market with existing and new structural products.

As these homes are more traditional they tend to be finished and furnished traditionally. Therefore, post and beam starts have historically left less potential for other Canadian value added products such as windows, doors, interior finish and furniture. However, this situation is not static and opportunities are growing.

In the Attribute Analysis study post and beam construction was the most favoured by builders. Consumers selected all styles of construction in equal fashion.

Post and beam construction tends to be used in high and low end homes while 2x4 (Section 3.2.2) have gained market penetration mostly in the middle range of home value. In the low cost range post and beam houses are built using low cost materials and very simple joinery making them lower cost than 2x4 houses.

3.2.2 2x4

North American platform frame construction (called 2x4 in Japan) was introduced to Japan in 1974 and is expected to surpass the 100,000 annual starts mark early in the next decade. During the downturn of 1997-1998 2x4 construction faired comparatively better than post and beam construction in the market.

2x4 construction uses building materials very similar to those used for platform frame construction in North America. Therefore, Canada and the United States are the primary suppliers of structural wood materials for this market (see Sections 4 and 5 for further discussion of wood materials for 2x4 construction). In addition, as these homes are of a North American style the opportunities to supply other wood products for these houses are much greater than for post and beam homes. 2x4 style homes are often finished with North American style doors, windows, flooring, furniture, and decking (see Sections *7,8,9*).

2x4 construction was initially thought to be a cheaper alternative to post and beam construction. However, this has not become a market reality. High labour costs and the overuse of materials has placed the 2x4 home in the mid to upper market. For the lower end of the market 2x4 construction cannot compete with low priced post and beam.

Consumers and builders were asked to indicate their preference for different construction types on several different questions in the attribute study. Throughout the study there were only marginal differences among the systems. It would appear that the 2x4 system is recognised for its good seismic performance and its North American style as it was selected about one third of the time by consumers. In reality the market share of 2x4 construction is less than 15% of wood housing starts. This would indicate that there is still significant room for growth in the 2x4 construction market.

Canadian producers are well positioned for this market as the species currently specified in the codes for 2x4 construction are North American. Further, Japanese Agricultural Standards are making a shift towards accepting NLGA standards for lumber. However, Japan has now opened its first dimension lumber mill using Hokkaido spruce. This a possible threat to North American J-grade producers if more dimension mills come on line.

3.2.3 Hybrid

The third and largely evolving construction style is hybrid housing. There is no official description of this housing style, nor are statistics kept. Hybrid construction incorporates elements of 2x4 and post and beam construction, such as adding wall sheathing or 2x4 interior framing to a post and beam structure.

The concept of a hybrid house was very popular with builders and consumers in this study. A hybrid house would allow Japanese consumers to have a traditional looking house with the increased strength and interior layout flexibility of a 2x4 house.

This system has not been fully explored or defined and therefore represents an opportunity for Canada to benefit from being first movers in this field. Canada has an international reputation for having developed and refined 2x4 construction into a high performance system. This reputation has allowed Canadians to play a central role in developing the 2x4 system in Japan. The reward for this has been the specification of Canadian species in the building codes.

Canada can play a major role in defining the future of hybrid building systems in Japan. We must seek out opportunities for our experts in platform frame construction to collaborate with Japanese experts in post and beam construction. This would benefit the Japanese market by providing it with a new building system. In return Canada could benefit by creating a greater market for its products. 2x4 construction accounted for only 12.5% of Japanese wood housing starts in 1998 (JAWIC). Hybrid construction would increase our potential market for dimension lumber and structural panels. As hybrid houses still use post and beam members the BC coast could supply this part of the market as well.

Canada has a diverse forest resource capable of supplying materials for 2x4, post and beam, and hybrid construction. Our resource is capable of producing large timbers for post and beam members and dimension lumber for 2x4 construction. From the perspective of a hybrid house demanding both of these types of products Canada is at a comparative advantage to other wood supply regions. The bundling of all wood inputs for a hybrid house package may present an opportunity for us to develop a 'Canada Hybrid House' brand recognition much like the 'Sweden House' brand currently in the market.

It was shown in the Attribute Analysis study that the country of origin of wood products is of little importance to builders, pre-cutters and consumers. However, the style of a house is much more identifiable than the wood it is made of. Style was the most common reason for replacing a home for consumers in this study. The study showed some preference for 2x4 style housing which is a style identified as being North American and non-traditional. It would be of great benefit to the Canadian industry if hybrid houses too, are to be identified as a North American style combined with Japanese traditions.

3.3 Construction Location

Construction location is another way in which Japan's wood housing market can be segmented. Houses can be built entirely on site, partially in a factory as with pre-cutting, or fully pre-fabricated in a factory.

3.3.1 On-Site

Traditionally, wood homes were built on site in Japan. These were post and beam style homes where all structural framing and joinery was performed by craftsmen on site. As mentioned above, the number of post and beam craftsmen is declining in Japan forcing a move towards factory production.

2x4 is the other construction method which is used on site. Since the introduction of 2x4 construction into Japan in 1974 there has been an ongoing concern for the efficiency of site building these homes. As with post and beam, the availability of work crews for this type of construction is tight. Further, there is a lack of understanding of the building system by crews which often leads to slow construction, material waste and construction errors. The Centre for International Trade in Forest Products conducted an

extensive study on 2x4 construction in Japan. Table 7 displays some of the cost differentials in building a comparable home in Japan and the US Pacific Northwest.

Table 7 Additional Cost of Building a 2x4 Home in Japan when compared to the US

	Framing	Total House
Materials	376.69%	296.60%
Labor	151.13%	163.30%
Total	*266.35%*	*239.62%*

Source: Eastin et al., 1999

3.3.2 Pre-cutting and Panelizing

Pre-cutting is the preparation of wood members for post and beam construction in the factory instead of on the building site. Pre-cutting is partially a response to the decreasing labour force for traditional construction. In addition, it allows homes to be constructed quicker as ready-to-assemble structural components are shipped to the construction site. Pre-cutting is also very efficient. It uses computer aided manufacturing to cut precise joints which minimise waste (Figure 7).

Figure 7 Pre-cut Operation in Japan

Post and beam construction has rapidly shifted toward pre-cut structural members in the 1990's. In 1998 there were 890 pre-cut mills which supplied the structural members for over 200,000 of post and beam homes up from 50,000 in 1990 (FAS 1998, Japan Lumber Reports, 1999). Pre-cutting now accounts for up to 40% of post and beam building starts.

The characteristics of the pre-cutting business have caused some major changes to the building and building products industry. As wood is cut in the factory for later assembly on site it is very important that the wood is dimensionally stable. Pre-cut operations cannot use green timbers for this reason. This

has led to declining demand for green timber imports from Canada, and increased demand for kiln-dry solid and engineered products.

Pre-cutting is also forcing the distribution of wood to change. As pre-cutters deal with much larger volumes of wood than any one traditional builder does, they are able to eliminate the middlemen and deal directly with mills and importers.

The final change that pre-cutting has brought about is a shift towards hybrid structures. In optimising manufacturing efficiencies and structural properties there has been a move towards co-ordinating pre-cutting with the pre-fabrication of wall panels (FAS 1998).

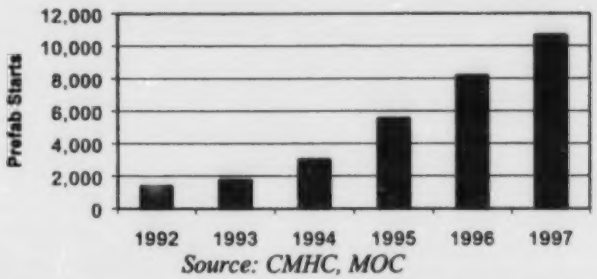
3.3.3 Pre-fabricated

Fully pre-fabricated homes have accounted for 5-6% of wooden housing starts in the past 5 years (JAWIC). Pre-fabricated homes can be modular but are most often panelized. Additionally, they can be post and beam but are more often 2x4 or hybrid. The source of pre-manufactured homes is mostly domestic with a growing number of imports. Of the domestic companies 94% of production comes from two manufacturers, Misawa and SxL.

On January 1, 1999 the Japanese government removed all tariffs on prefabricated buildings. This has opened the door to panelized and modular imports from Canada and the US. This is part of an effort to promote housing imports in order lower the cost of Japanese housing.

Imports of houses in 1997 were over 10,500 units, 40% of which were Canadian (CMHC 1999). The US Department of Commerce expects Japanese housing imports to reach 20,000 by 2001/2002.

Buyers of North American style pre-manufactured homes are generally in their 30s and 40s, living in the suburbs of large cities. This demographic has likely travelled or lived in North America and is familiar with North American housing styles (US Dept. of Commerce, 1997). The style of North American homes is very important to these younger, less traditional consumers. In addition, the performance of 2x4 homes in the Hanshin and Kobe earthquakes had consumers looking at them for performance.

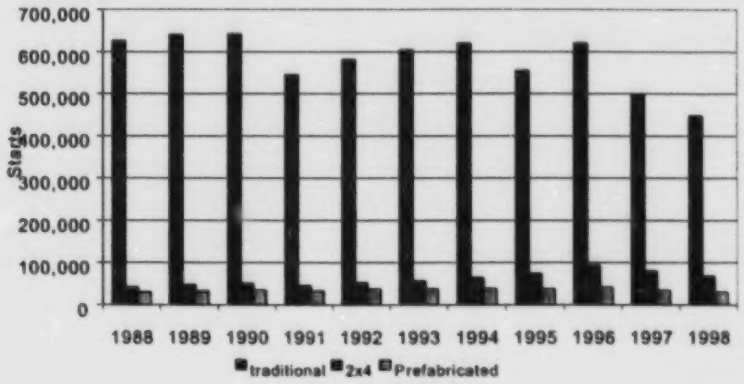


Source: CMHC, MOC

Figure 8 ***Imported Prefabricated Housing Starts***

Even though buyers of prefabricated 2x4 homes are somewhat untraditional there are some key traditional elements any home must have. These are the tatami room, the genkan entrance, and a bathroom with a separate room for the toilet and a traditional bathtub.

Pre-fabricated homes offer some of the best opportunities for Canadian companies to export value added products. By pre-manufacturing homes here in Canada we not only sell structural lumber but we add the value of processing it into a home. In addition, we have the opportunity to source local wood interior finish items. It is estimated than North American pre-fabricated home manufacturers can use up to 60% domestic materials (wood and non-wood). The other forty percent of building materials are specific to Japan such as fixtures and faucets.



Source: JAWIC

Figure 9 Japanese Wood Housing Starts

Given this background on wood use in Japan for housing, the remainder of this report discusses supply and demand linkages related to the six product groupings identified in the attribute analysis:

Section 4	Building Systems
Section 5	Wood Structural Members
Section 6	Engineered Structural Members
Section 7	Furniture
Section 8	Interior Finish
Section 9	Outdoor Furnishings and Decking.

4 Building Systems

Major trends and opportunities in building systems include;

- Hybrid structures,
- Performance of structures (seismic),
- Healthy house,
- Changes in the Building Standards Laws,
- Government promotion of :
    1. Lower cost construction
    2. Imported housing
    3. Increased per capita floor area
    4. Seniors housing
- Multi-family wood structures in suburban areas.

4.1 Attributes Demanded in Japan

The attributes demanded were studied through simple survey questions of respondents as well as from the conjoint analysis, as reported in the attribute analysis publications identified in Table 1.

4.1.1 Survey Question Results

Builders, pre-cutters, and consumers were asked some general survey questions about building systems, materials, and other issues outside of the conjoint analysis. Probably one of the most important questions is what type of building system or construction methods are prefered.

Figure 10 displays construction methods prefered by pre-cutters, builders, and consumers. When reviewing these results one must keep in mind that pre-cutters only business is in post and beam homes. Further, of the buildings constructed by builders in the survey 56.4% were post and beam, 22.6% were 2x4, and 13.2% were some hybrid mix of the two systems. The highest preference of all three groups is still for post and beam construction. However, it is evident that all groups are open to modified post and beam homes (with panels) and to 2x4 construction.

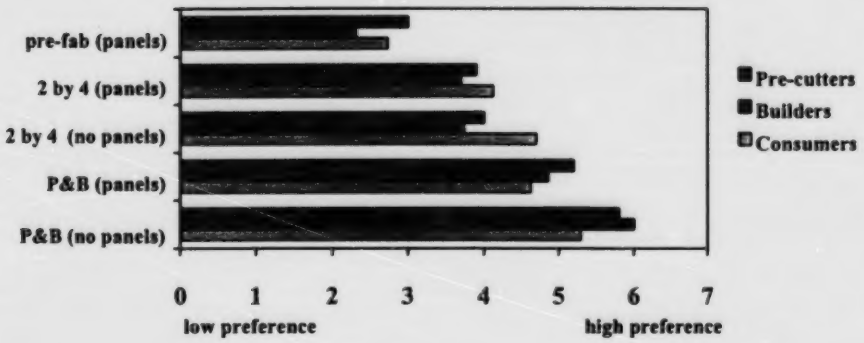


Figure 10 Preference for Building Systems.

Consumers were also asked directly which type of house they most preferred. Table 8 indicates that many consumers are now considering 2x4 wood construction. This is a popular option for younger, less traditional, consumers.

Table 8 Construction Type Preferences

Type of House	% of 225 Consumers
Wood 2x4	24.4
Wood post and beam	20.9
Mix of P & B and 2x4 (hybrid)	20.0
Steel or concrete	16.4
Don't care	10.2
Pre-fabricated	8.0

Builders expect post and beam construction to decline to 49.4% of the market. They expect this to be replaced by increases in 2x4, hybrid, and non-wood construction of 27.8%, 15.3%, and 5.5% respectively. Builders expect small decreases in prefabricated construction of 1.9%.

Beyond building system preferences, consumers and builders were asked to indicate their preference for different structural materials (
Figure 11). Solid wood was most preferred by both groups. However, it is interesting to compare the preferences for engineered wood products. Builders rated these products to be much preferable to steel and concrete. Consumers, on the other hand, rated engineered wood to be only slightly preferable to steel and concrete.

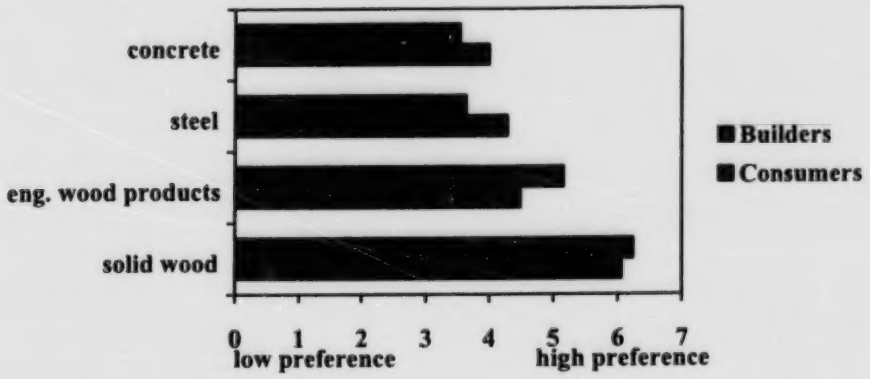


Figure 11 Structural Material Preferred

indicate a lack of awareness by consumers that engineered wood is being used in non-visual applications, and veneer wrapped in visual applications.

Consumers were also asked why they replace their existing housing. It is very interesting to note that less than 10% or respondents expecting to replace their house are doing so due to structural reasons (Table 9). The most common reason cited for replacing a home was for a style change followed by decay. Many of the reasons to replace a home are related to the high cost of doing renovations in Japan. Style changes, additions to size, and other renovations are common in North America but are prohibitively expensive in Japan. This points to the opportunity of providing lower cost renovations in the Japanese market.

Table 9 Reasons for Replacing House

Reason	% of total Consumers
current house needs style	27.9
current house is no longer sound due to decay	21.7
current house too small	19.5
other	13.6
current house needs costly renovations	10.7
changes current house is no longer structurally sound	6.6
Total	**100**

To help determine whether there would be an increase in houses for extended families the following question was asked "Who do you expect to live in your new house?" It is very interesting to note that 43% of respondents indicate that they expect their extended family (husband, wife, children and parents) to live in their new home once purchased or built. The remaining 57% expect the currently typical immediate family, husband, wife and children, to live in their new home.
It follows that consumers plan to build large houses:

- 31 % of respondents expect to build a house > 1,650 square feet (>50 tsubo or >165 m^2);
- 28 % expect to build a house between 1,320 and 1,650 ft^2 (40-49 tsubo or 132-165 m^2);
- 26 % between 990 and 1,320 ft^2 (30-39 tsubo or > 99-132 m^2); and
- only 15% less than 990 ft^2 (30 tsubo or 99 m^2).

The house sizes indicated by respondents suggest that single-family dwellings will continue to increase in size. This is consistent with a government living space initiative to increase living space per capita in Japan from 30m^2 in 1999 to 40m^2 by 2005.

Strength and durability were rated the most important attributes by consumers and builders. It is interesting that consumers placed these performance attributes above whether the house was detached and the house size itself (Table 10). It would appear that the Hanshin earthquake has raised the profile of the performance of buildings. Of moderate importance for builders were the method of construction, design, and structural material used.

Table 10 Most Important Attributes of House System

Attribute	Consumers	Builders
Strength (earthquake preparedness)	1	2
Durability (how long the house will last)[a]	2	1
Whether the house is detached	3	7
House size	4	8
Design (e.g. western, traditional Japanese, mixed)	5	4
Structural material (wood, steel, or concrete)	6	5
Method of construction (e.g. factory built, 2x4, post & beam)	7	3
Country of origin of most building materials	8	-
Green versus dry	-	6
Size of structural members	-	9

A growing issue in building systems in Japan is the concept of "healthy house". A major component of this is the perception of formaldehyde as an indoor air pollutant. Builders and pre-cutters were more aware formaldehyde emissions than consumers were (Table 11). However, consumers are more willing to pay a small premium for panels with formaldehyde emissions below current standards.

[a] Follow up interviews during the first two weeks of September, 1998 explored what Japanese builders and consumers meant by durability. Their definition changed based on the context. That is if they were referring to one situation they would define durability as rot resistance while in another situation they would refer to durability as strength.

Table 11 Formaldehyde Emissions

Formaldehyde Emissions from Panels		
	Aware?	**Pay Premium?**
Consumers	66%	77%
Builders	95%	44%
Pre-cutters	97%	46%

Upon follow-up visits to Japan the researchers on this project found evidence that the 'healthy house' concept is gaining in importance. There are reports of buyers opting out of low GHLC mortgage rates to use non-approved building techniques which use less chemicals. This is a testament to the strength of the healthy house movement.

4.1.2 Conjoint Analysis Results

Below is a discussion of the results of the conjoint analysis of building systems. These results take into account the tradeoffs made by specifiers when faced more than one product attribute (see section 2.1 in the methods section, or report Attribute Analysis - Methodology) for further discussion of conjoint analysis).

Price
There is relatively even distribution of house prices. Substantial niches exist for both high end and low end housing. Opportunities exist for a higher priced house design using hybrid construction methods since consumers selecting higher priced houses preferred hybrid houses most frequently followed by post and beam and lastly 2x4. Additional growth in 2x4 construction is expected in the mid price ranges where it is almost equal to other construction methods. The surprise is the strong interest in hybrid house design for virtually every price range which indicates some distinct opportunities for both design, materials and house packages.

Distribution
There were no significant differences among the five choices for distribution source of wood. This indicates either builders do not care where their wood supplies come from or there are sizeable niches committed to each type of source for wood. What is surprising is the strong showing of retailers as a source for building supplies. When small builders are constructing two story detached houses they select wood from local pre-cutters most frequently, followed by a national supplier or trading house. A local wholesaler is selected least frequently. For three story detached houses there is little difference between distribution sources for wood materials. For connected row houses wood is preferred from many sources and for apartments the selection favoured local suppliers.

Source of Wood
Japanese and Canadian woods are the most selected types of wood with European a close third. The percent that selected European wood is still less than their current market share indicating room for additional growth at the expense of Canadian wood. The similarity of percentages indicates that switching between wood sources is most likely common. Canadian and European wood are selected most frequently for mid priced house. For lower priced houses there was a slight preference for European wood. Higher priced houses preferred Japanese wood followed by European wood and Canadian wood.

Canadian wood is never the most preferred material for any price range. This is tempered by the fact that source of wood was one of the lowest ranked attributes throughout the study (Table 10).

Construction Method
As expected there is strong support for post and beam construction by builders. Consumers selected traditional post and beam, 2x4 and hybrid construction methods each about one third of the time. This indicates that 2x4 has room for substantial increases in market share given its existing level is less than 15% of current wood house construction. The biggest surprise is the large proportion of builders and consumers selecting hybrid houses.

House Type
Over two thirds of the respondents prefer detached houses. The most interesting result is that *almost 14% selected row housing*. This method of construction is not common in Japan and these results may indicate a potential niche market for Canadian design of townhouses using Canadian wood products. The vast majority of new single-family house construction is replacement housing usually on a single lot. A large proportion of the remainder builds houses on single, vacant lots. The tendency to build on single lots combined with land ownership patterns in Japan limit the potential for row housing beyond niches in regions where new development can, and does, occur.

Durability
This was one of the two most important attributes for consumers and builders. However, the Japanese are unclear as to the definition of the term durability. As the life span of a house increased, respondents selected durability more frequently. About two thirds of respondents selected a house that would last longer than the current average (40 or 50 years with a current average of about 25 years).

It is not believed that the Japanese intend to make their next generation of houses last this long. Instead, we believe that respondents interpreted the durability of a home that would last 40 or more years to be that the building would last very well for the expected service life of their home. This is because durability is associated with seismic performance in Japan. There seems to be a perception that a house built to last longer will perform better in earthquakes.

Builders linked durability to source of wood. European wood is expected to go into houses that lasted the longest. Canadian wood, Japanese wood and lastly other imports followed it. Canadian wood ranked quite well and stressing the durability of houses built from Canadian wood should be considered for promotional material, especially since there are houses still standing that were built in the early seventies. Post and beam houses are considered to have the shortest life span with builders decreasing their selection of this building method as the longevity of the house increased. The exact opposite is true for both 2x4 and hybrid houses that are selected more frequently as durability increased.

With design being the most important reason to replace a house (Table 9), structural longevity and decay resistance will not be enough to increase the life span of a typical house in Japan. Interiors must be designed for ease of remodelling to facilitate changing room structures and adding additional rooms (due to change in size and family structure to be housed). In addition the realm of maintenance would need to be addressed. House maintenance is very rare in Japan as is renovating.

Strength
Almost 80% of respondents selected strength requirement that surpass the existing building code. While not surprising for a country which lived through the devastating Hanshin Earthquake, it does indicate

some potential for building systems designed and promoted for their superior strength. Strength also ranked as the most important product attribute in the questionnaire.

Healthy House
A great majority of consumers, builders, and pre-cutters were familiar with the issue of formaldehyde emissions in the home. Among consumers three quarters indicated a willingness to pay a premium for a panel with 1/50th of the current emission standard. For builders and pre-cutters less than 50% were willing to pay a premium for lowered emissions. The study also found an interest in a quality assurance label for building systems and products. If these two concepts could be combined into a "Canadian Healthy House" label our industry could benefit from a brand recognition if they are the first to the market with such a label and the products to back it up.

4.1.3 The Evolving Japanese Market

Incentives
Housing activity in Japan has been depressed with the recent economic conditions. The government has set in place incentives to spur home building. As of January 1, 1999 two different home buying incentives began. The first set of incentives revolves around tax incentives and the second around tariff reductions.

The tax incentives program is set to last for two years. It increases the size and duration of tax deductions based on home loans. It applies to new and used homes, lots, and renovations over a certain size. As regards tariff reductions on buildings the elimination of tariffs on imported prefabricated buildings is expected to have the largest impact.

In addition to the above incentives, the Government Housing and Loan Corporation (GHLC) offers mortgage rates as low as 2.0%. The GHLC finances over half of new homes constructed in Japan.

Building Codes
Conventional structures in Japan fall under the Building Standards Law (BSL). The BSL sets out prescriptive regulations for wood framed construction. In addition to the BSL there exist the Technical Standards for Wooden Platform Frame Construction, or 2x4 Standards. The 2x4 standards are both prescriptive and performance based. The method of obtaining proprietary building system approval in Japan is through article 38 of the BSL. Any new product or system which is not covered under the BSL or the 2x4 standards can apply for approval under article 38.

The Building Standards Law has recently been revised to focus more on performance standards. These revisions will start taking effect early in the new year with full implementation up to two years away. Under the revisions Section 38 will be replaced by another proprietary system approval provision under Section 68 of the Building Standards Law.

Houses built in fire protection and quasi fire protection zones are subject to strict fire codes. Quasi fire protection zones include suburban areas where much of the single-family starts are located. Therefore, fire regulations are a major consideration for housing imports.

Many building products must be JAS (Japan Agricultural Standards) or JIS (Japan Industrial Standards) approved. The standards for each building product comprising a prefabricated home will have to be researched to assure compliance.

Mortgages

The Government Housing Loan Corporation (GHLC) provides discounted mortgages with the mandate to promote home construction. Over 50% of single-family detached homes are financed through the GHLC. The GHLC can provide different levels of financing depending on the conformance of a house with certain initiatives and its use of GHLC approved building materials. For any prefabricated home to find a market in Japan it must be eligible for GLHC financing. Therefore, special attention must be paid to using GLHC approved products.

Warranties

Warranties are extremely important in Japan. Home builders typically offer a 10 year warranty on houses. As of April 1, 2000 a 10 year warranty on structural framing workmanship will be required by law on new construction.

Tariffs

As of January 1, 1999 prefabricated buildings can enter Japan tariff free. Table 11 includes a list of Canadian products which can be included in a prefabricated building system and their associated tariffs which would apply if they were sold as individual products.

Table 12 Tariff Schedule for Selected Products as at January, 1 1999

Product	HS Code	Tariff
Soft wood flooring	4409.10	3.7%
Hard wood flooring	4409.20	free
Moulding	4409	3.6%
Particleboard/OSB	4410.11	6.0%
Fiberboard	4411	2.6%
Plywood/laminated wood	4412.00	6.0%-10.0%
Wood windows/frames	4418.10	free
Wood doors/frames	4418.20	free
Parquet panels	4418.30	2.0%
Shingles/shakes	4418.50	2.9%
Tategu/tokobashira	4418.90	free
Stairs	4418.90	3.9%
Structural laminated lumber - glulam	4418.90	3.9%
Wood in the rough	4403	free
Soft wood sawn/chipped lengthwise	4407.10	4.8%-6.0%
Douglas fir	4407.10	free
Prefabricated buildings	**9406.00**	**free**

Source: JETRO Housing Materials Center Osaka, FAS 1999

4.2 Product and System Opportunities

Seven opportunities were identified in the linkage analysis for building systems. These are;

1. Single-Family Hybrid Houses (some pre-fabrication)
2. Hybrid Houses (fully prefabricated)
3. Panelized Multi-Family Homes
4. Mid-Ply™ Wall System
5. RoRo Modular Housing
6. Row Houses.

4.2.1 Single-Family Hybrid Houses (Some Pre-fabrication)

Hybrid construction appears to have great potential in Japan. Consumers in this study displayed a preference for this type of construction at all price levels. This is likely because the concept of a hybrid house mixes the post and beam tradition with the strength, flexibility, and North American style of 2x4 construction.

From an industry structure perspective the hybrid house also appears to be a good fit. With the growing shortage of housing craftsmen the shift to greater pre-manufacturing of housing components will help provide quality construction at reasonable prices. It is only natural that as pre-cutting becomes more common builders will increasingly combine this with prefabricated wall components to speed construction and limit the use of on site labour.

The further benefit of the hybrid house is that it rationalises the distribution channels for lumber as the pre-cutters and panelizers consume sufficient volumes to deal directly with forest product companies or wholesalers.

As mentioned in Section 3, there is not an official statistical or building code classification for hybrid houses. If this type of structure is to become prevalent in the Japanese market in coming years it would be beneficial for Canadian firms if Canada played a role in the definition, testing, and codification of the hybrid category.

Hybrid housing provides several of the attributes demanded by consumers and builders. From a strength and durability perspective the hybrid house provides superior performance to post and beam homes. By utilising some prefabrication on-site building costs can be reduced, providing competitive prices for hybrid houses. Further, hybrid houses can be designed for flexibility of renovations.

4.2.1.1 Production Issues

Japan has an adequate and growing production capacity for pre-cutting. There are currently about 1000 pre-cut facilities in Japan supplying about 200,000 starts annually (Japan Lumber Reports, 1999). The infrastructure for pre-fabricated wall panels also exists in Japan. The opportunity for Canada is to provide technical service and the wood inputs to the Japanese pre-fabrication infrastructure.

The first major production issue is likely to be the co-ordination of the pre-cutters and panelizers. The two issues here are compatibility and timing. Since the structural members and panelized walls are not

produced in the same plant there is the potential for incompatibility due to only small size discrepancies. Further, as these components will be coming from different plants the builder will have to carefully co-ordinate their timely delivery to avoid delays.

Alternatively, it may be possible to move some of the component manufacturing operations to Canada if schedules could be met. At present the Japanese have the expertise and infrastructure in pre-cutting. This could be acquired in Canada to complement the production capacity and expertise in building wall assemblies that already exists.

In the short-term transition to pre-cutting Japanese manufacturers are operating above capacity. While this may appear to be an opportunity we can expect that investment in pre-cutting facilities will be made in Japan.

4.2.1.2 Resource Issues

The hybrid house does not create any new resource issues as lumber for both 2x4 and post and beam construction is openly available in Japan. However, the Canadian resource does provide an opportunity in that our diverse forests can produce both dimension lumber for wall panels and timbers for post and beam members.

4.2.1.3 Market Access Issues

Table 12 contains a list of products and their associated tariffs which may apply to Canadian exports to the Hybrid house market. It is interesting to note that at the lowest (wood in the rough) and highest (prefabricated buildings) levels of value added there are no tariffs. It is the building materials such as panels, lumber, and glulam that face tariffs in Japan. By building wall panels in Canada for export to Japan more value is added and tariffs may be avoided.

4.2.1.4 Competitive Issues

As this "product" does not identify specific wood products, the trade model cannot be effectively utilized here to analyize the future competitiveness of BC/Canadian supply in Japan. This also holds for the other "products" under building systems. However, the trade-flow scenarios discussion under Wood Structural Members and Engineered Wood Products will apply here to some degree.

From the information presented in *Competitor Analysis One* on the overall supply and demand of softwood products globally and the trends in trade, a few general observations can be made regarding the competitiveness of BC/Canadian exports of building systems to Japan.

First and foremost, the trend over the past has been for Japan to switch from less processed products (i.e. logs) to more processed products (i.e., lumber, panels, engineered wood products, mouldings, joinery, etc.). This trend exists *in spite* of the fact Japan continues to protect its domestic wood processing industry with high subsidies, and that the purchase power of the Yen has declined in recent years against major wood supplying countries' currencies. This is a positive note for Canadian exports of all wood products including building systems.

It was also shown, however, that Japan's extensive post-war softwood tree plantings are nearing harvestable age. While Japanese domestic supply of softwoods is clearly a competitive threat to Canadian supply, this threat may not apply to all wood end-uses in Japan. The reason for this is that these vast plantations have not been well attended to, leaving the quality of the sawn lumber questionable for certain applications, including its use in 2x4 construction and post and beam/2x4 hybrids. Figure 12 illustrates with typical Japanese cedar (Sugi) baby squares suitable only for vertical members in a post and beam house. It can be seen that the diameter of the trees from which it was cut is small, and this is typical of the dense Sugi plantations of Japan. Given the high percentage of juvenile wood, cracking is prevalent, and lacks the strength needed for horizontal applications.

Finally, when thinking about the competitiveness of Canadian building systems in Japan, it must be remembered that even if Japanese domestic log supply is inadequate to meet demand, it is certainly possible for the use of imported lumber over imported building systems. However, as shown in Figure 8, the Japanese already import a considerable volume of the ultimate in a building system, the manufactured home. Given the desire of the Japanese government to reducing home costs, and expensive domestic materials and labour, there is no reason for the trend shown in the figure to reverse. The bigger question will be Canada's competitive position relative to competing suppliers such as the US and, to a lessor degree, Scandinavia.

Figure 12 Japanese "Sugi" Baby Squares

4.2.2 Hybrid Houses (Fully Prefabricated)

The second way in which to approach the hybrid house market would be to fully prefabricate the buildings in Canada. This would have several benefits.

- All components of the house are tariff free
- Value added by Canadian workers
- High degree of Canadian materials utilised
- High degree of control over the evolution of the hybrid house
- Opportunity for branding
- Association with Canadian secondary wood products.

4.2.2.1 Production Issues

There exists a strong prefabricated building industry in Canada with the experience of exporting to Japan. However, this industry generally has experience in panelized 2x4 construction and not in the post and beam pre-cutting function. The skills and equipment for pre-cutting would have to be acquired in Canada to produce a prefabricated hybrid home.

The pre-cut business in Japan is based on the technologies of Computer Aided Drawing (CAD) and Computer Aided Manufacturing (CAM) of which we are familiar with in Canada. Further, the processing equipment could likely be acquired to do the actual manufacturing. Indeed there exists one prefabricator in British Columbia with the capacity to pre-cut posts and beams.

The largest deficiency may be our lack of design expertise in post and beam design. If we are to design a hybrid of the 2x4 and post and beam construction methods it will be very important to include Japanese experts in the design process. There are two ways in which we may want to proceed with the design of the hybrid house. The first way would be to be the manufacturer of Japanese designs. Houses could be designed and sold in Japan and the specifications sent to Canada for manufacture. The second option would be to design a hybrid house with Canadian technology and style for sale in Japan.

By fully prefabricating a house in Canada there is an opportunity to use a high percentage of Canadian building products. The greater the level of prefabrication the greater the opportunities are to include Canadian products in the unit at zero tariff. The US Foreign Commercial service estimates that 40% of materials used for prefabricated building exports to Japan must be of Japanese origin due to different specifications and styles. In addition, some Japanese wood veneers may need to be incorporated into prefabricated homes to get the preferred interior finish. Secondary products which could be incorporated into the hybrid system could be wood floors, stairs, wainscoting, mouldings, windows, doors and cabinets.

4.2.2.2 Resource Issues

Canada has a diverse forest resource which currently supplies both the 2x4 and post and beam markets. As these buildings are to be prefabricated and then shipped in components to Japan it will be very important that all wood components are dimensionally stable. This will require all wood to be kiln-dried.

Japanese builders and consumers have preferences as to the colour and species of wood used in certain applications. If the hybrid house is to have exposed posts and beams this may have to be accounted for material specification. Traditionally the Japanese like dark wood, specifically Douglas-fir, for beams. Posts are typically of lighter coloured wood such as hemlock.

As indicated above, wood veneers of Japanese species may have to be imported to finish exposed posts and beams.

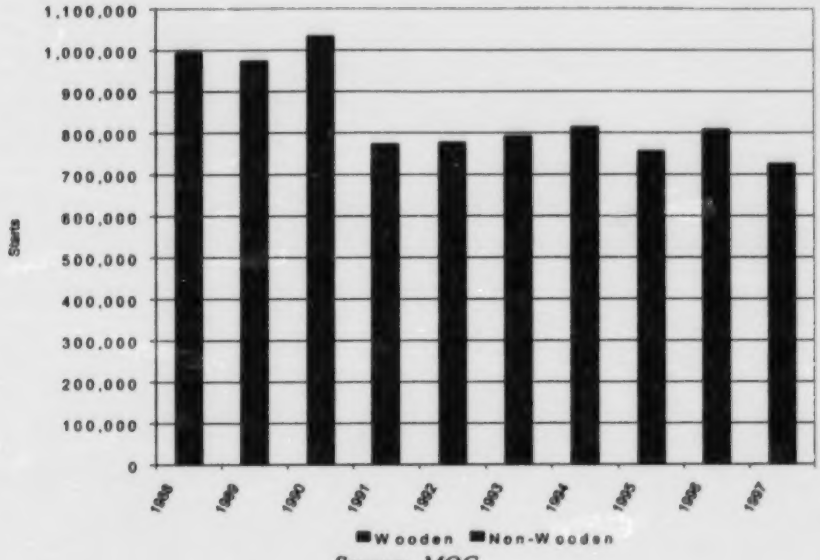
4.2.2.3 Market Access Issues

As the fully prefabricated hybrid home does not necessarily exist it does not have any direct competitors at present. However, the number of homes to be built in Japan per year is finite. Therefore, all sources of new housing are competitors, and non-tariff barriers may be encountered.

4.2.3 Panelized Multi-Family Homes.

The approval of three-story multi-family homes for location in quasi fire protection zones presents the potential for a boom in the wood based rentals market. Three levels will entice land owners to build more wooden rental housing in quasi fire protection zones as the added floor allows for greater revenue off a single plot of land. To put the magnitude of this development into perspective, up to 70% of Greater Tokyo is classified as a quasi fire protection areas.

Figure 13 displays the breakdown of concrete and wood multi-family starts in Japan. With three-story multi-family homes allowed in the suburbs it is expected that wood starts will increase. This will be moderated by the fact that most wood multi-family units are for rental apartments not condominiums as discussed in 3.1.2. Further, wooden multi-family structures will still be limited to being relatively small (3 stories) and excluded from urban areas.



Source: MOC

Figure 13 Annual Multifamily Starts

The demographic of renters tends to be young professionals. Many young professionals have been schooled or have at least visited North America. This has lead to a preference for North American style living which a 2x4 multi-family wooden structure could offer. A North American style structure may help owners attract tenants at premium rental rates.

A further incentive to owners of wooden apartment buildings is the tax benefits they have over concrete structures. The depreciation period for a wooden rental building is 24 years as compared to a 60 years for a concrete building.

4.2.3.1 Production Issues

Companies in Western Canada are currently producing panelized multi-family structures for exports to the US.

Design is a very important production step for this opportunity. Any multi-family structure must meet the code specifications in Japan. Structures must also be designed with Japanese preferences in mind.

4.2.3.2 Resource Issues

Structural framing materials for panelized multi-family homes will be JAS approved dimension lumber. This is best kiln dried as the movement of wood members due to drying may distort prefabricated panels while in transport.

By prefabricating entire structures there exist the opportunities to use more than just Canadian softwood lumber. Higher value wood for interior finish, cabinets, doors and windows can also be utilised.

4.2.3.3 Market Access Issues

Multi-family wooden houses of three stories can be built in quasi fire zones for floor areas up to 3000 square metres. These buildings must have fire resistant exterior materials, balconies or other evacuation provisions, and are restricted as to the size of openings. In addition, prefabricated buildings can now be exported to Japan without tariff. Table 13 is an example of the fire requirements for these structures.

Table 13 Fire Requirements for Multi-Family Wooden Houses

Partition Wall	1 hour
External Wall (load bearing)	1 hour
External Wall (non-load bearing, parts liable to catch fire)	1 hour
External Wall (non-load bearing, other)	30 minutes
Columns	1 hour
Floor	1 hour
Beams	1 hour
Stairs	30 minutes
Soffits	1 hour
Roofs	30 minutes
Inside of Roof	30 minutes

Source: MOC

4.2.4 Mid-Ply™ Wall System

Mid-Ply™ is a hybrid wall system designed to provide high sheer strength for dynamic loads such as wind and seismic. The system was developed at Forintek Canada Corp. and is currently in the final stages of testing.

The Mid-Ply™ wall system could supply a good fit to the two most important attributes for building systems, strength and durability. The Mid-Ply™ wall system is designed to provide superior sheer strength to conventional 2x4 wall systems. As traditional post and beam walls are not sheathed, they provide even lower sheer strength than the 2x4 system. The Mid-Ply™ wall system provides a practical method to attaining high strength walls.

It was found that the definition of durability differed among Japanese respondents on a case by case basis. The best interpretation of durability as it applies to building systems is the mechanical durability of the system in an earthquake. As the Mid-Ply™ wall system is designed for seismic loads it is well suited to provide the durability attribute.

The Mid-Ply™ wall system could be used in any wood framed start in Japan where durability is an issue. This system would provide excellent strength properties to otherwise laterally weaker post and beam houses. Mid-Ply™ wall systems could also be manufactured in co-ordination with pre-cut operations to make a hybrid house.

Other opportunities for the Mid-Ply™ wall system may be the multi-family market to give strength to larger structures.

4.2.4.1 Production Issues

The Mid-Ply™ wall system can be produced in several degrees of pre-manufacture. The system can be sold as a technology with the hardware the only parts. This is the lowest degree of value added since the wood inputs can be sourced anywhere. The next level would be to sell a package of pre-cut wood and hardware for assembly into a Mid-Ply™ system. Finally, the system can be sold as a completed wall panel.

The pre-fabricated wall panel could be used for prefabricated homes or as high strength inserts for post and beam homes. This would offer the highest value added to the Canadian industry if these panels were produced domestically. Similar to above discussions of panelizing, production and transportation would have to be closely co-ordinated with the builder in Japan.

4.2.4.2 Resource Issues

The Mid-Ply™ wall system requires regular panels of OSB or plywood and dimension lumber (2x3 or 2x4).

4.2.4.3 Market Access Issues

Mid-Ply™ is not a convention system under the Building Standard Law or the 2x4 Standards. Therefore, it would likely require Section 38 (or new the new Section 68) approval as a proprietary product. Testing would be required to prove the Mid-Ply™ wall system is equal or superior to conventional walls.

4.2.5 RoRo Modular Housing

While the US Department of Commerce expects imported housing in Japan to reach 20,000 units in 2000/2001, the Japanese Ministry of Construction goal set in the mid-1990s was 50,000 units by this time. For this reason it is expected that any effort to export houses to Japan will be supported by authorities.

RoRo modular housing is an example of an innovative approach proposed to meet the Japanese demand for building systems.

RoRo modular housing is a high value added concept for the western provinces. British Columbia is the largest Canadian of supplier prefabricated buildings to Japan. In 1998 61% of BC prefabricated building exports were to Japan. These are primarily panelized assemblies which are containerized and shipped to Japan. In total, Japan imported $88.8 million in prefabricated buildings from Canada in 1998, down from 181.6 million in 1997 (Industry Canada).

The RoRo modular housing concept developed by Hazelden and Bazley (1997) allows for further onshore manufacturing and added value. RoRo is named for the roll-on/roll-off vessels that would transport these modules to Japan by taking advantage of back-hauls on these motor vehicle carriers.

A single-family detached house would consist of five to six modules placed together at the building site. Modules could be manufactured to a great degree of finish in Canada before being exported to Japan for final assembly. This system allows for fast erection of a house. Further, it requires minimal work by Japanese finishing crews that are short of supply and expensive.

Modules could be designed for any type of residential building; detached, row houses, and apartments.

Figure 14 An Example of Modular House Components

4.2.5.1 Production Issues

Existing capacity in the manufactured or modular home industry in Western Canada could produce these modules. Each module would be restricted to 2.9m wide, 8.2m long, and 3.7m high due to transportation constraints. Therefore, a finished house in Japan would require five to six modules.

The modular nature of RoRo housing allows for a high degree of finishing. For the most part walls, floors, doors, windows, and cabinets can be installed in Canada. This is in addition to plumbing, wiring and HVAC.

There are two technical hurdles for the production of RoRo modular homes. The first is to design and produce fasteners to hold the modules together. The second hurdle is the production of a steel carriage to transport units on.

Except for the two technical issues identified above the major hurdles for this concern transportation. Units must be shipped from the factory to a port which offloads cars from RoRo carriers. The timing of

the shipment must be right to load the units as soon as the carrier offloads as the port and vessel time is very expensive.

Once in Japan the modules must be easy to offload quickly. Further, as terminal space will be limited these modules must be moved either to a building site or a holding area. Transport in Japan is more difficult than in Canada as the roads are smaller and there are several permits that must be obtained.

4.2.5.2 Market Access Issues

Transportation restrictions are one of the larger market access issues. However, there are production related market access issues which have not been addressed before by offshore manufacturers. As the modules will be pre-finished to include electrical, plumbing and HVAC there is the question of accreditation and inspection. Although inspection is currently not as strict in Japan, amendments to the Building Standards Laws will increase inspection. Further, although though inspection may not be common in Japan services such as electrical must be installed by accredited professionals. This is market access hurdle which must be addressed.

4.2.5.3 Competitiveness Issues

Although this technology originated in Canada any country which imports cars from Japan could potentially produce RoRo housing.

4.2.6 Row Houses

The definition of row house for this study was the North American style townhouse (unit separated vertically but not horizontally), which largely does not exist in Japan. However, in the trade-off analysis, consumers selected row housing 13.9% of the time and builders 22% of the time as house type. For this reason it is suggested that the opportunity of row housing is considerable for Japan.

It has already been discussed that land ownership patterns make this type of housing difficult. These structures could be constructed outside of the Japan's three largest centres. Tracts of land being redeveloped by the Housing and Urban Development Corporation could be used for row housing.

Row houses have two promising target markets. The first is government housing for low income families. The second opportunity for in seniors developments. In both cases good quality and low priced construction is needed. Herein lies the opportunity for Canadian companies. We are able to produce pre-fabricated wood structures at low prices relative to Japan. Producing identical panels for multi-unit developments only increases our efficiency. It is suggested here that pre-manufactured home builders co-operate with Japanese officials to introduce row housing.

5 Wood Structural Members

Major trends and opportunities for wood structural members include:

- Move to pre-cut post and beam, requiring kiln dried wood components, creating post & beam house opportunities for
  - Lamstock
  - Premium Solid SPF Member
  - Dry Solid Hemlock Structural Member, as Well as Other BC Coastal Species
- Generally, opportunities for
  - Borate Treated Lumber
  - Increased J-Grade exports with continued expansion of platform frame home construction.

5.1 Attributes Demanded in Japan

5.1.1 Survey Question Results

The two groups interviewed for the wood structural members portion of the study were builders and pre-cutters. Due to the nature of their businesses, results differ between the two specifier groups.

The primary concerns of pre-cutters are strength and whether the member is dry versus green (Table 14). Sizes, security of supply, utility and durability were ranked as moderately important. Source of material and distributors are of little importance to pre-cutters.

The most important attributes for builders are strength, price, utility (how much of purchased material is usable in the final house) and species. Colour and treatability are also of some importance. This product group is the only one where durability is of little importance. However, this may be a result of builders assuming all structural members are durable. Finally, it is interesting to note that where builders purchase these members (distributor) and source of supply (defined as country of origin) are of little importance.

Table 14 Most Important Attributes for Engineered Structural Products

Attribute	Pre-cutter's Rank	Builders' Rank
strength	1	1
dry versus green	2	N/A
sizes	3	10
security of supply	4	11
utility	5	3
durability	6	8
species	7	4
source of supply	8	12
distributor	9	13
treatability	10	6
colour	11	5
weight	12	8
price	N/A	2
finish	N/A	7

Builders and pre-cutters were asked to indicate their preference for different types of wood structural material. Results were similar for both. The greatest preference is for dry solid wood members, followed closely by laminated lumber. Far behind is green solid wood. These results held true for both vertical and horizontal members as is clear from Figure 15.

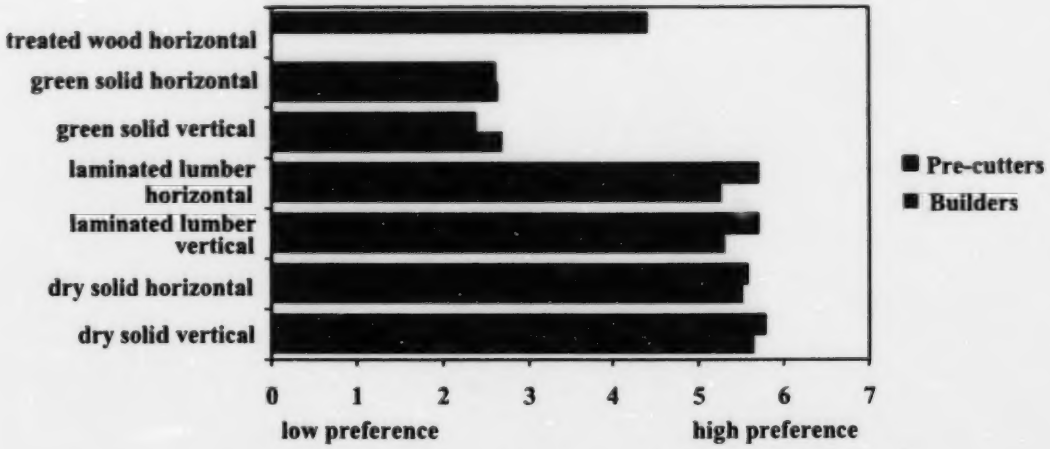


Figure 15 Preference for Material in Wood Structural Members

While there was a preference for a mix of connectors (metal and notching) that occurred in the factory this was not a strong preference. It is clear from Figure 16 that both builders and pre-cutters want to keep some of the traditional task of notching when connecting structural members in houses rather than switch completely to new metal connectors.

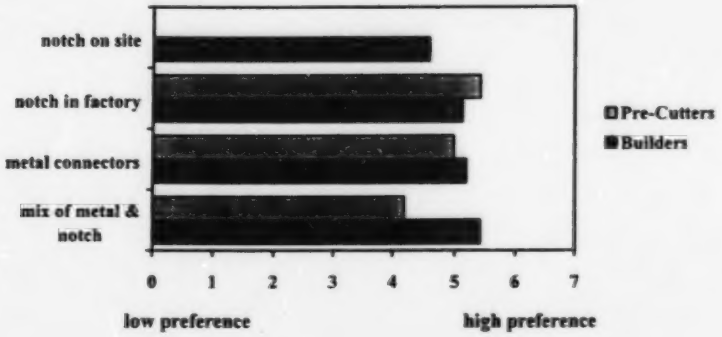


Figure 16 Preference for Type and Location of Connections

5.1.2 Conjoint Analysis Results

Price
For wood structural members, low price is the strongest selling point for any product. Builders and pre-cutters are reluctant to pay premiums and very few selected 20% premiums regardless of the attributes. Pre-cutters and builders are very price sensitive. However, as price increases the proportion that select Hemlock and Scandinavian white wood declines much more quickly than for SPF or Japanese Sugi.

Species
Species is considered a fairly important attribute by builders. Japanese Sugi is the most preferred species selected by over two thirds of respondents. Hemlock is the second selection followed closely by Scandinavian white wood and SPF. Builders consider the following species to be slightly stronger than code (in rank order) Japanese Sugi, Scandinavian white wood, hemlock and last, SPF. The species builders consider if the member is to be much stronger than code are similar to the list above except Hemlock ranks second and European white wood ranks third.

Pre-cutters selected Japanese Sugi most frequently followed by SPF, Scandinavian white wood and lastly Hemlock. Hemlock was selected less than 20% of the time. This differs dramatically from builders who select Hemlock as their second choice. SPF maintains its rank as second most favoured wood at all price ranges but this may be due to the strong preference from pre-cutters for dry material.

Weight
Builders and pre-cutters do not consider weight on its own to be very important attribute. About one third of the builders prefer members that are lighter in weight than average and another third prefer members

heavier than average. This may be due to builders' assumption that weight is related to strength. There is little indication of a willingness to pay any premium for wood structural members that weigh less.

Distribution
Distribution source is not considered a very important product attribute and ranked very low. Almost three quarters of respondents prefer to purchase from local suppliers whether they are retailers, wholesalers or pre-cutters. Only 16% selected national suppliers as their preferred distribution source.

Sizes
There is no significant difference between different available sizes. Pre-cutters can remanufacture their purchases to desired sizes and the relative importance of utility suggests that there is little value to pre-cutters by purchasing pre-sized components.

Strength
Strength is the most important attribute of wood structural members for builders. Almost three-quarters prefer members that either slightly or greatly exceed building codes. However over a quarter selected members which just met minimum codes. This is a clear indication that builders want stronger structural members. There is a willingness to pay a premium for strength but it did not increase from slightly stronger than code to much stronger than code; that is some builders are willing to pay a premium for strength but not a 20% premium and not for a much stronger product.

Strength is also the most important attribute for pre-cutters. Almost three-quarters of the pre-cutters prefer members that either slightly or greatly exceed building codes. However over a quarter select members, which just met minimum codes. Both builders and pre-cutters want stronger structural members but are not necessarily dissatisfied with strength that just meets minimum building code. As strength requirements increase, pre-cutters select Japanese Sugi much less frequently although it still remained the species of choice. Pre-cutters select SPF most frequently as the strength requirement increases.

5.1.3 Japanese Demand Factors for Wood Structural Members.

As discussed in Section 2, Japan has had annual housing starts of between 1.2 and 1.65 million in recent history. This high level of housing starts is due to the frequency of rebuilding, with the life span of a Japanese home being under 25 years. This high level of building activity represents a major market for Canadian wood products.

Just under half of the annual housing starts in Japan are wood-based construction. Of these, post and beam construction accounts for the majority of starts (Figure 2). Platform frame construction, while growing, still has not surpassed the 100,000 level. This means that while '2x4' dimension lumber demand is growing, the largest opportunities remain in larger dimension lumber and timbers for post and beam construction in the short run. In the medium run, however, opportunities for dimension lumber are likely to grow more substantially with the move toward more engineered wood products and hybrid building systems.

Section 2 offers a more complete overview of demand factors for wood based housing in Japan.

Table 15 shows the results of a recent survey on wood used in post and beam houses. Fifty large homebuilders in Japan were surveyed as to the type of wood used in posts, beams and sills. The survey

was performed early in 1999 by the Japan Forest Products Journal. One must use caution when looking at these statistics the wood use of these large builders may be very different than by smaller builders. The 101 largest builders in Japan accounted for 9.6% of post and beam starts in 1997 (additionally, they build 35.9% of 2x4 starts, and nearly 100% of prefabricated wood starts).

The most striking result of this survey is that laminated posts have all but displaced hemlock for posts in this market segment. However, hemlock remains strong for sills with alternative preservatives to CCA. Douglas fir is the preferred species for horizontal members with 71.8% of the market between solid and laminated members. It should also be noted that at least 46.1% of the wood used in horizontal members is kiln dried.

Table 15 Structural Components Used By Major Wooden Home Builders

	Applications/Species	Percent
Posts	Laminated Lumber	**60.8%**
	Sugi	**17.6%**
	Hinoki	**10.9%**
	Hemlock	**4.2%**
	Other	**6.4%**
Horizontal Members	Douglas fir	
	green	**34.3%**
	kiln dry	**24.7%**
	Laminated Lumber	
	Douglas fir	**12.8%**
	Whitewood	**8.6%**
	Other Laminated	**6.0%**
	Other	**13.6%**
Sills	Hemlock	**72.1%**
	Yellow Cedar	**11.2%**
	Hinoki	**11.3%**
	Laminated Lumber	**0.2%**
	Other	**5.1%**

Source: Japan Forest Products Journal, 1999

5.1.4 Attributes Supplied by BC/Canada

5.1.4.1 The BC Resource

The BC softwood timber resource is indicated in Table 16. The 1997 harvest was 22.3 million cubic meters from the coast, and an additional 46.3 million cubic metres from the interior. This yielded lumber production of 3.0 million board feet and 10.3 million board feet on the coast and interior, respectively (Table 17).

Table 16 ***BC Mature Standing Coniferous Timber Volume***

(million cubic metres)- as at Dec 31, 1996[b]

Species	Coast	Interior	Total Province
Spruce	113	1,463	1,576
Hemlock	1,183	294	1,477
Balsam (true firs)	416	856	1,272
Lodgepole pine	27	1,473	1,500
Douglas fir	133	287	420
Red cedar	289	96	385
Yellow cedar	109	<0.5	109
Red/Yellow cedar[c]	261	15	276
Larch	-	28	28
Yellow pine	<0.5	9	9
White pine	1	6	7
Misc.	<0.5	10	10
Total Softwoods	*2,532*	*4,537*	*7,069*

5.1.4.2 Characteristics of Species

An appendix to this report contains the characteristics Canadian wood species as the result of tests on small clear samples. As wood is a variable material the results of clear sample tests cannot be used for design purposes. Instead design values are calculated for different grades and species mixes from testing on full size members. The appendix also contains the NLGA design values for timbers and dimension lumber for BC species.

For timbers, the Douglas-fir/Larch species group has the greatest strength properties. This is followed by species separated Western Hemlock. The Hem-Fir species group has lower assigned strength properties as Amabilis fir has lower values than western hemlock. The species group of spruce-pine-fir, Coast Sitka spruce, and cedars all have similar strength properties. However, their modulus of elasticity (MOE) values are very different. Sitka spruce is very stiff with an MOE of 1.5×10^6 psi for select structural. SPF has a corresponding MOE of 1.3 and western cedars of 1.0.

5.1.4.3 Infrastructure and Technology

In 1997 Canada produced 64 million cubic meters of softwood lumber, 48.8% of which was produced in British Columbia.

[b] 1998 COFI Factbook

[c] This volume from TFL's. Data does not separate red and yellow cedar.

Table 17 ***BC Lumber Production by Species 1997***

Species	Coast	%	Interior	%	Total	%
Douglas Fir/Larch	464.2 MMBF	15	590.9	6	1,055.1	8
Red Cedar	799.2	26	169.8	2	969.0	7
Yellow Cedar	125.4	4	2.0	0	127.4	1
HemFir	1,564.0	52	428.9	4	1,992.0	15
Sitka Spruce	48.2	2	0.0	0	48.2	1
S-P-F	28.9	1	9,109.8	88	9,138.7	68
Other	1.6	0	43.2	0	44.8	0
Total Lumber	3,031.6	100	10,343.6	100	13,375.3	100
Production Share	22.7		77.3		100	

Source: COFI Factbook 1998

The estimated 1998 lumber production capacity of British Columbia was 13,375.3 MMBF from a total of 246 mills[4].

5.1.5 General Competitive Position

Canada exported $11.1 billion of softwood lumber in 1998. British Columbia accounted for over half of this at $6.4 billion. Japan as a destination for our lumber exports typically accounts for over $2 billion in softwood lumber exports, most of which is from British Columbia. (Figure 17 and Figure 18.)

Canada has remained Japan's single most important supplier for solid softwood lumber. However, market share has been eroding in recent years, primarily to Scandinavia and Austria. (Figure 19 and Figure 20.)

Note: The Appendix to Competitor Analysis One shows trade-flow trends for softwood lumber by species.

[4] BC Ministry of Forests

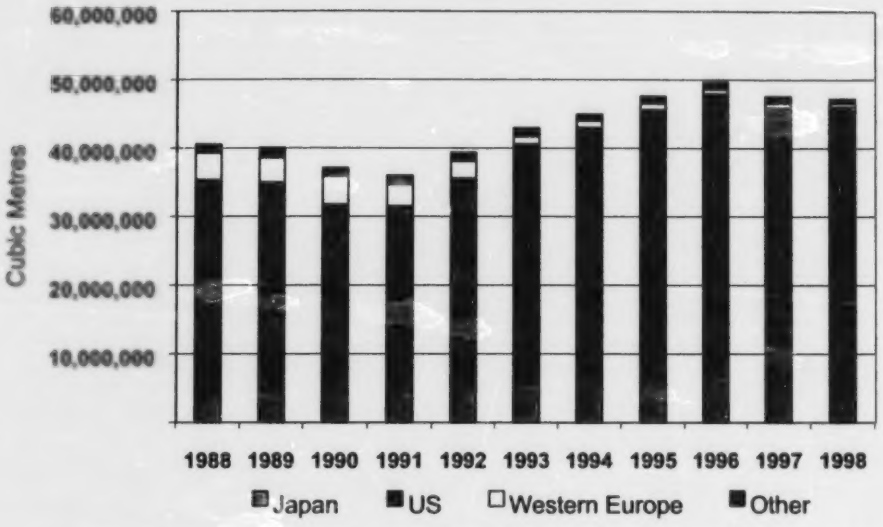


Figure 17 **Canada Exports of Softwood Lumber, Volume**

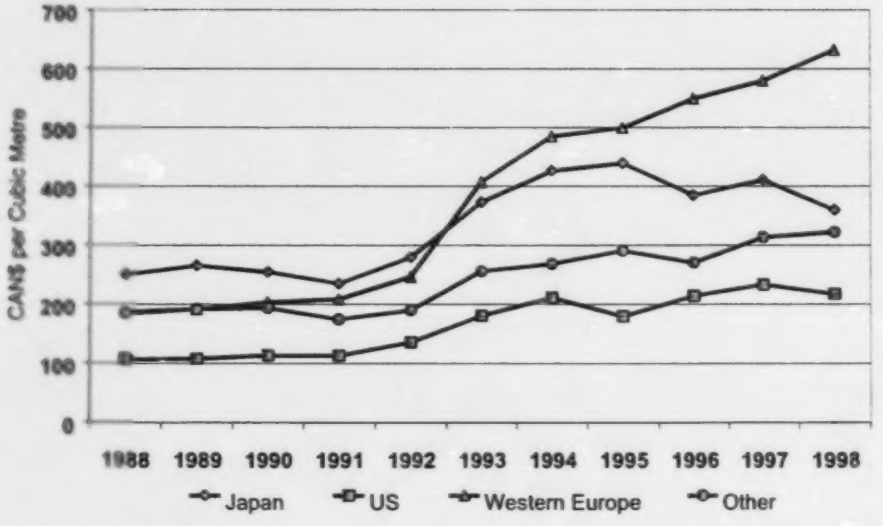


Figure 18 **Canada Exports of Softwood Lumber, Unit Value**

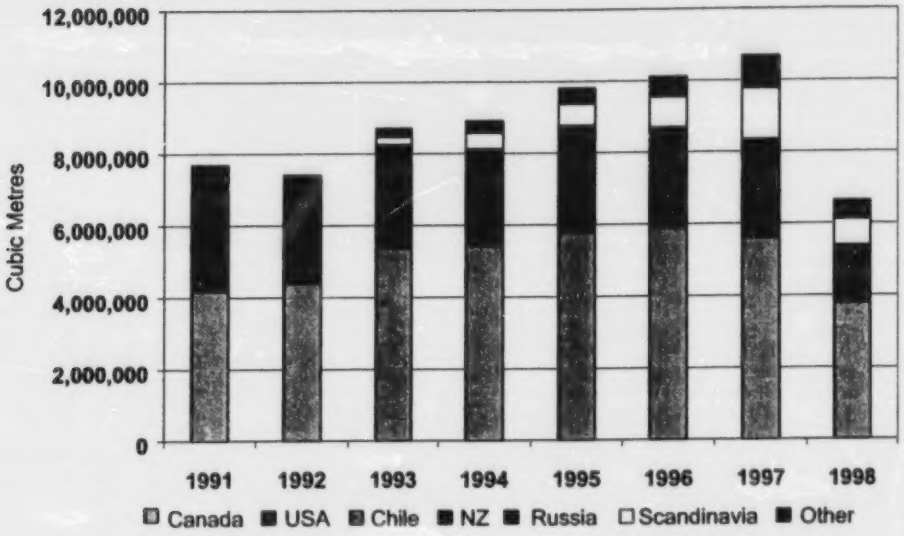


Figure 19 *Japan Imports of Softwood Lumber, Volume*

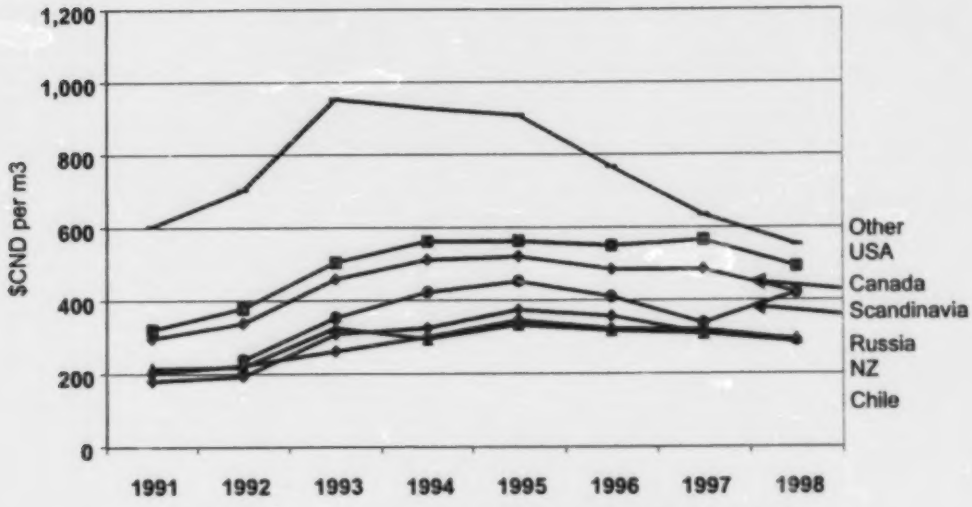


Figure 20 *Japan Imports of Softwood Lumber, Unit Value*

When considering the competitive position of Canadian exports of softwood lumber over the next decade (extrapolating the variables that have caused the trends shown in Figure 17 through Figure 20), it must be recognised that trade is becoming more dynamic. Many structural changes have been observed for the trade of softwood lumber. This includes increased delivered log costs in BC, more global trade (such as the market share gains witnessed in Japan by Europe), global plantations coming on stream, the decreased purchase power of the Japanese Yen and the associated changes in their demand, the emergence of engineered wood products and the growing use of non-wood substitutes, the Canada/US Softwood Lumber Agreement, and political chaos in Russia. What changes are we likely to see in the next 10 years? What will be the effects of relative exchange rates on Canada's competitive position? What will happen if the plantations of New Zealand switch from exporting logs to exporting lumber and engineered wood products? What will Japan's economy and housing starts do, and how will that affect Canada's market share? What would be the global trade-flow result if Russia, which holds 60% of the world's softwood timber stock, returns to historical levels of lumber production? What if Japan increases their investments in their considerable softwood plantations? What if harvests trend upward in the US West? The answers to these questions ALL have profound implications to Canada's ability to compete in Japan and elsewhere.

As reported in *Competitor Analysis One* and *Competitor Analysis Two*, a global trade model was developed for this study as a tool to help address such questions for the future. What makes this trade model unique to other models to be found in the literature is that it recognises that softwood lumber is *not* a homogeneous commodity. That is, that there are differences in the supply and demand of Radiata pine from New Zealand, for example, and yellow cedar from the BC Coast. Or even that there are differences between dimension lumber from Canada and dimension lumber from the US. Conventional trade models do not show this, but rather assume that softwood lumber from one place or grade is a perfect substitute for lumber from anywhere else or any other grade. This is, of course, an incredibly limiting assumption.

The approach taken by the authors to accomplish this task was to take the vast amount of global trade data and to break it down into categories based on price. With softwood lumber, these categories included two levels of an "appearance" grade (two as the price spreads are so wide), a Japan construction grade (which would include US select structural and MSR lumber), and a US construction grade, These are referred to in the following discussion as softwood lumber #1 through #4, respectively.

This task basically involved three steps:

1. Collect and calibrate production, consumption and trade-flow data (both volume and unit value) for 7 identified supply regions globally and 4 identified demand regions for 1997; working with production, consumption and trade data by species and location, to group these into the four categories as stated above.
2. To develop and implement a trade-model using the 1997 data to determine the ability to predict known production, consumption and trade-flows for these supply and demand regions.
3. To make base-line forecasts for the years 2002 and 2007 for each grade category, from which various "scenario analysis" could be measured against.

These "scenario analysis" were the main point of the exercise. They correspond to the questions above regarding variables that can have strong impact on Canada's ability to compete in the future in the Japanese market place.

In *Competitor Analysis One*, it was shown how the first step was accomplished. *Competitor Analysis Two* detailed the second and final step. In this report, step 3 is expanded to include additional scenario analyses to aid in evaluating the future competitiveness of some of the identified wood products in the linkage analysis. As there is not global trade data on softwood flooring, for example, the trade model could not always be used. However, the fact that lumber was not treated as a homogeneous commodity helps in this regard. To continue the example of softwood flooring, the authors can match the value of this product to the appropriate grade class of softwood lumber to get an idea of its competitive vulnerability to unknown future events.

5.1.5.1 The Base-Line Forecast for 2002 and 2007 for Global Softwood Lumber Trade

Base-line forecasts of future softwood lumber trade were developed as explained in the competitor analysis reports. The purpose of the forecasts are two fold. First, to get a "best guess" on future trade based on a number of assumptions on exporters' and importers' price response behaviour and expected changes in supply and demand for all of the regions identified in the model. The second, and more important purpose is to crate a benchmark from which the scenario analyses can be measured. These include challenging the assumptions of the base-line forecast and new possibilities, such as significant increases in Russian supply.

The assumptions made for the base-line forecasts are all itemised in detail in *Competitor Analysis Two*. These are a few examples of sorts of assumptions made:

- Canada supply of softwood lumber #1 and #2 (SWL 1 and 2) decrease by 1.5% and 1% annually, respectively, from 1997 to 2007;
- New Zealand supply of all categories of softwood lumber increase by 10% annually from 1997 to 2002, then by 20% to 2007;
- Chile supply of all categories of softwood lumber increase by 10% annually from 1997 to 2007;
- US Importer supply of SWL 4 drops by 1% annually from 1997 to 2002, then by 1.5% to 2007;
- Russia supply of SWL 3 and 4 remains unchanged from 1997 to 2002, then increases by 5% annually to 2007;
- Western Europe supply of SWL 2 through 4 increase by 1% annually from 1997 to 2002, then remain unchanged to 2007.

Figure 21 and Figure 22 offer example results of the base-line forecasts, offered in its entirety in *Competitor Analysis Two*. Some of the more significant occurrences are:

- Canada exports of softwood lumber #3 to the US goes up over time (representing "select structural" and MSR grades), driven by the assumption of increased US demand and lower prices due to decreased Japanese demand;

- Canada exports of softwood lumber #3 to Japan declines over time (representing the Japan construction or "J" grade), driven by the assumption of lower demand in Japan due to decreased annual housing starts;

- Canada exports of softwood lumber #4 to the US declines over time (representing US construction or #2 and better grade), driven by the assumption of reduced demand by both US importer and US exporter;

- Canada exports of softwood lumber #1 and #2 to Japan remains relatively stable when combined (representing appearance grades);

- US exports of softwood lumber #1 and #2 to Japan declines;

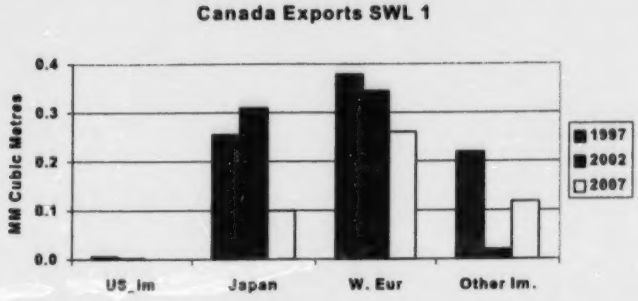
- US exports of softwood lumber #4 to US importer increases (to partially offset reduced imports from Canada);

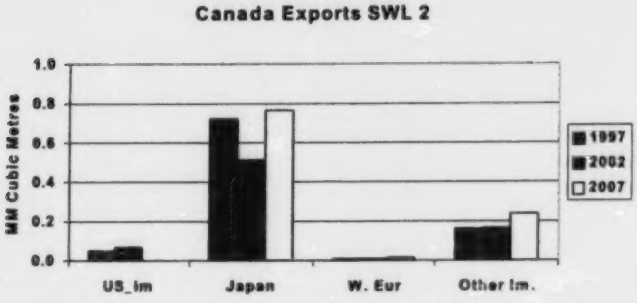
- Scandinavian exports of softwood lumber #3 (which represents most of Scandinavia's production) declines to Western Europe and increases to "other" importers, driven by the assumption of reduced demand in Western Europe and simultaneous increased supply in Western Europe; while at smaller volumes, this is also true of softwood lumber #4; Scandinavian exports of softwood lumber #3 to Japan declines;

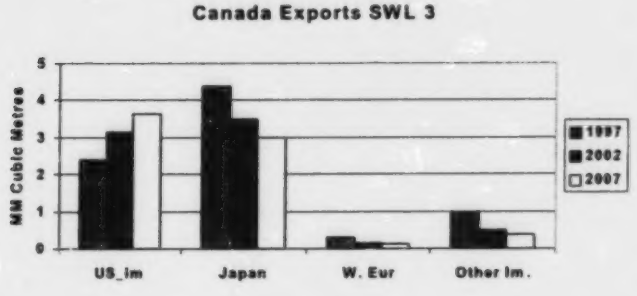
- Russian exports of softwood lumber #3 to Japan remains stable; exports of softwood lumber #4 increases to "other" importer;

- New Zealand and Chile exports of all categories of softwood lumber increase significantly, to all import regions except the US, driven by the assumption of significant increase in supply by these two supply regions;

- "Other" exporter sees a significant drop in the export of softwood lumber #3 to Western Europe, declining to zero by 2007, driven by the assumption of large increases in domestic demand by "other exporter".







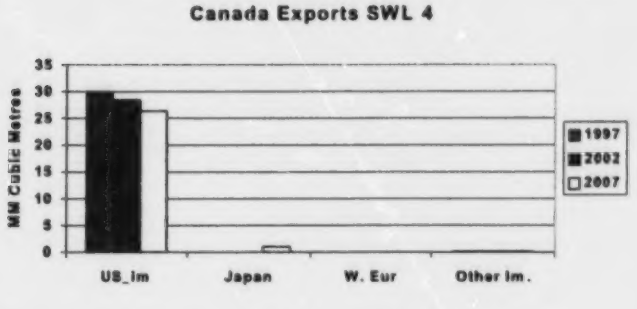


Figure 21 Base-Line Forecast of Canada Exports

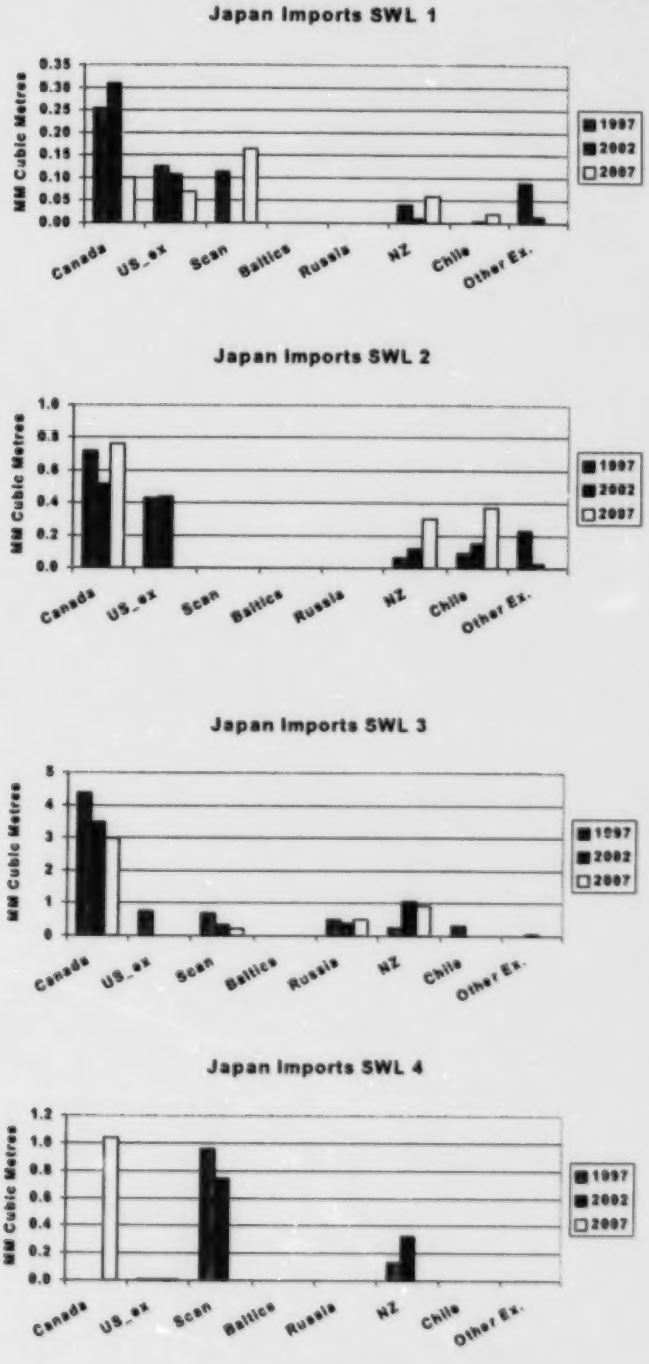


Figure 22 Base-Line Forecast of Japan Imports

5.1.5.2 The Softwood Lumber Scenarios

Competitor Analysis Two offered a number of individual scenarios against the base-line forecasts for softwood lumber #1 through #4. These scenarios were purposefully negative to show areas of vulnerability for Canadian lumber exporters, including:

- Challenge the assumption of zero supply growth of US "exporter" each of the categories of softwood lumber; rather increase supply in all categories of softwood lumber 2% annually through 2007.
- "Shock" the model by increasing Russian supply of softwood lumber #3 and #4 dramatically.
- "Shock" the model by decreasing the Canada/US quota allocation dramatically.
- "Shock" the model by decreasing Scandinavian currencies relative to other exporting regions relative to the US dollar.

In each one of these cases, it was shown where Canadian exporters were the most vulnerable to market share loss moving to 2002 and 2007. In the first and third scenarios listed, Canadian exporters are the most vulnerable in the US construction grade, or softwood lumber #4, followed by the Japan construction grade (the price range also defines US select structural and MSR), being softwood lumber #3.

The third scenario, being increased Russian supply of softwood lumber #3 and #4, lead to *dramatic* market share losses for Canada in Japan and the US, respectively. Finally in the fourth listed scenario, being an exchange rate swing to Scandinavia's benefit, Canada looses considerable market share in softwood lumber #3 in Japan.

There was also one *potentially* positive scenario, being to:

- "Shock" the model by increasing "other importers'" demand for softwood lumber #3 and #4.

This scenario did not prove to be beneficial for Canadian exporters (nor US exporters), with the increased demand being met by Scandinavia and Chile for softwood lumber #3 and from Russia and "other exporters" for softwood lumber #4.

These scenarios will be discussed further throughout the remainder of this report when assessing individual linkages. At that time, additional scenarios will also be offered, including ones which could benefit Canadian exporters, and where several "what-if" questions are addressed simultaneously. For example, what if the Canadian dollar appreciates relative to competing supply regions' currencies, and US NET imports of defined categories of softwood lumber increase.

In addition to the trade model scenario analysis, on a general level it should be noted what Japan's overall tariff schedule is, as reported in Table 18. When considering the competitiveness of individual Canadian products in Japan, one must also consider potential changes to these rates, as well as non-tariff barriers such as continued subsidies of the domestic forest products industry by the Japanese government.

Table 18 Tariff Schedule for Selected Products as at January 1, 1999

Product	HS Code	Tariff
particleboard/OSB	4410.11	6.0%
fiberboard	4411	2.6%
plywood/laminated wood	4412.00	6.0%-10.0%
tategu/tokobashira	4418.90	free
structural laminated lumber - glulam	4418.90	3.9%
wood in the rough	4403	free
soft wood sawn/chipped lengthwise	4407.10	4.8%-6.0%
Douglas fir	4407.10	free
prefabricated buildings	9406.00	free

Source: JETRO Housing Materials Center Osaka, FAS 1999

5.2 Linking Demand with Supply - Product Opportunities

Five key product opportunities were identified for wood structural members in the linkage analysis. These were:

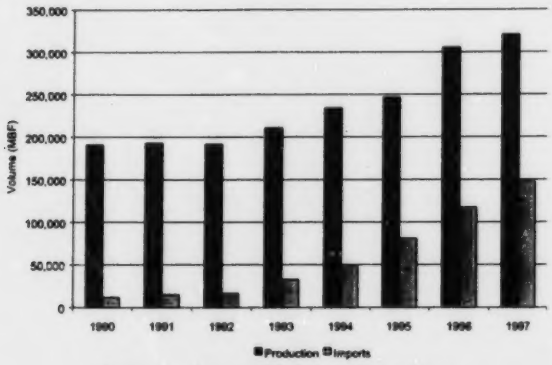
1. Lamstock;
2. Premium Solid SPF Member;
3. Dry Solid Hemlock Structural Member;
4. Borate Treated Lumber;
5. Borate Treated Dodai.

5.2.1 Lamstock

Lamstock is a viable product opportunity for BC softwoods. This market is currently being served to some degree by the BC industry, however, opportunities exist to add more value to these exports.

Figure 23 displays Japanese production and imports of glulam. Both production and imports rose sharply between 1992 and 1997. This indicates that even with additions to capacity Japan could not produce enough glulam for its needs. Japan decreased its imports of glulam 64.7% in the first half of 1998 compared to the same period of 1997. Though no domestic production numbers are yet available for this period we would expect that production did not decrease with the same magnitude as imports. As Japan has built up significant glulam manufacturing capacity without a large domestic wood supply to back it lamstock is a promising product for the Japanese market that is less susceptible to economic risks.

There exists a market for commodity based lamstock sales to Japan. This is not likely to go away as glulam is becoming increasingly important in the market. This is due to the shift to pre-cutting and the need for KD material.



Source: Japan Glulam Association

Figure 23 Japanese Production and Imports of Glulam.

There are two ways in which value can be added to lamstock for export to Japan. The first value added product is a machine-stress-rated laminate for tension faces of glulam beams (see **Error! Reference source not found.**). By stress rating lamstock onshore a greater value may be achieved for selected pieces.

The second opportunity to add value to lamstock destined for Japan is to treat it with borates (see 6.2.7). Borates provide protection from decay and insect attack, which Japan is particularly susceptible to. Borate treatment would be appropriate for first level posts that make contact with the sill, and the possibly the sill itself.

Forintek Canada Corp. has very recently looked into the feasibility of laminating borate treated lamstock. It was found that borate treated lamstock can be adequately bonded with regular Phenol-Resorcinol-Formaldehyde (PRF) resins in the presence of added heat. At this time the Canadian glulam industry does not have the capability to cure glulam adhesives with heat, making this a technology we cannot currently use. However, the Japanese glulam industry is capable of heating glue lines and, therefore, could manufacture borate treated glulam. Further, work is being done at Forintek to make such bonds with lower temperatures.

These two value adding opportunities are covered in 6.2.6.

5.2.1.1 Production Issues

Japan demands both visually graded and mechanically graded lamstock for their glulam production. JAS standards prescribe the wood quality characteristics for a multitude of laminated lumber configurations. Factors considered for lamstock quality are strength, knots and holes, grain inclination, decay, splits, discoloration, rough grain, width of annual rings, moisture content, and planing tolerances.

Under new JAS standards glulam lay-ups are more flexible, as long as all lamina are approximately of equal width. This may allow for better recovery in Canadian mills.

5.2.1.2 Resource Issues

JAS standards for laminated lumber specify six groups of species by strength. Included in these groups are Douglas fir, lodgepole pine, ponderosa pine, larch, hemlock, and yellow cedar. The list is not exclusive. Any species meeting the strength properties of one of the six groups can be included in that group.

5.2.1.3 Competitiveness Issues

While lamstock is not reported in the trade statistics separately (it is combined with softwood lumber of the appropriate species), Scandinavia reportedly exports significant quantities of whitewood lamina (the Japanese term for Scandinavian spruce) to Japan for the production of posts (Japan Lumber Reports). The Japan Lumber Reports lists 22x107mm S4S whitewood lamina as trading at average prices which are at a slight premium to J-grade dimension lumber imports. In terms of the trade model, this would largely be softwood lumber #3 and to a lessor extent softwood lumber #2. As shown in *Competitor Analysis Two*, softwood lumber #3 exports from Canada are particularly vulnerable to exchange rate swings in Scandinavia's advantage and in increases in Russian supply. Neither of these scenarios affected Canada's competitive position of softwood lumber #2, as neither is a significant producer of this category. It was also shown that increased US supply of softwood lumber #3 is also a potential threat to Canadian lamstock in Japan, but less so.

Other than the "wild card" of Russia being able to attract investment in its lumber manufacturing industry, Scandinavia is clearly the largest competitive threat to exports of Canadian lamstock to Japan. This is followed by increased US supply, but given the US's excess capacity for glulam production, and a likelihood of increased glulam demand in the US, this is viewed as less of a threat.

Figure 24 illustrates the result of the following scenario: increased transportation costs for softwood lumber #3 from Scandinavia to Japan by $10 per cubic metre to reflect a increase in their currency relative to competing exports. This is the exact opposite to the scenario reported in *Competitor Analysis Two*, offering a range of possible outcomes, or a risk analysis to this one variable.

Note that while this did ultimately cause a shift of Scandinavian trade away from "other importers" to Western Europe, trade to Japan was NOT significantly effected. This suggests the Canadian exporters of softwood lumber #3 to Japan are highly vulnerable to Scandinavia competition, regardless of their moderate exchange rate advantages/disadvantages.

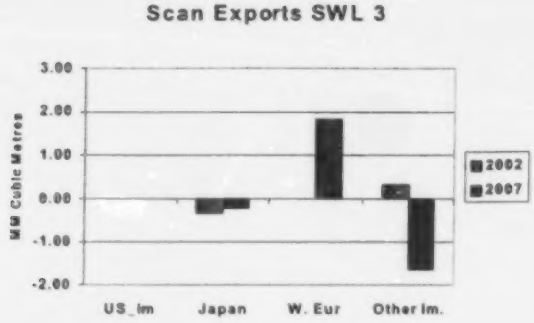


Figure 24 *Change in Exports from Scandinavia as a Result of a $10/m3 Increase in Transportation Costs to Japan*

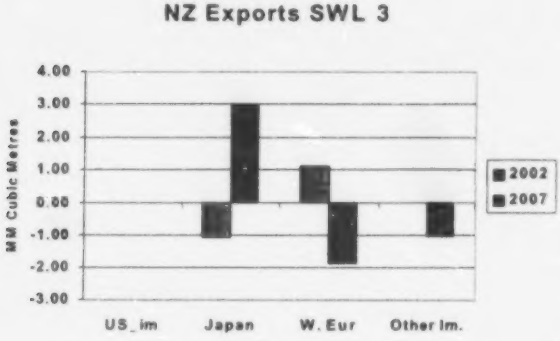


Figure 25 *Change in Exports from New Zealand as a Result of Increased Scandinavia Transportation Cost to Japan AND No Drop in the Japanese Demand*

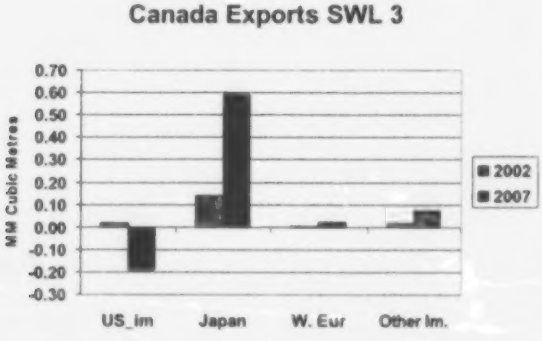


Figure 26 *Change in Exports from Canada as a Result of Increased Scandinavia Transportation Cost to Japan AND No Drop in the Japanese Demand*

If this scenario of increased transportation costs from Scandinavia to Japan is accompanied with no change in the demand for softwood lumber #3 in Japan from 1997 to 2007 (as opposed to the 2% annual drop in demand put into the base case forecast), Canada benefits with increased production and trade to Japan (with a small drop in exports to the US). While the growth of Japanese imports from New Zealand is larger than from Canada, this is less of a growth in New Zealand production, and more a shift in trade from other markets. (Figures 28 and 29.)

As a qualifying note, in the case of lamstock it is very possible that Canada could lose market share to New Zealand Radiata pine, as the Japanese do indeed utilise this species in their glulam production. Fortunately for Canadian producers of J-Grade dimension lumber (also softwood lumber #3), such substitution is less like to take place due to Japanese belief that solid Radiata pine is not strong enough. This means that that the result shown in Figure 26 could be over-estimating trade gains made by New Zealand.

This "weakness" in the model result could be mitigated by defining more softwood lumber price categories. The price spread between Canadian and New Zealand softwood lumber #3, C&F Japan, was almost $80 per cubic meter in 1997, yet both fell into the category of #3.

The fact that the Japanese view Canadian SPF as a different product from New Zealand Radiata pine, in spite of their similarity in price, is very important when interpreting the trade model results. The model assumes that all softwood lumber #3 is homogenous, or perfect substitutes for one another. If Canada can differentiate its product from "commodity" lumber based on strength or other attributes, the model demonstrated vulnerability of exports to Japan would be overstated.

As a further note on lamstock, it was noted in *Competitor Analysis Two* that Canada is most vulnerable it is markets for softwood lumber #4. The reason for this was shown to be that there really is not any significant demand for this product outside of North America. As a result the model scenario of reduced US demand led to reduced Canadian production.

Given this vulnerability, any opportunities to upgrade softwood lumber #4 to #3 should be explored. This has already been accomplished over the years with mills separating out J-grade lumber fir the Japanese market. The production of lamstock from wood that was destined for US dimension lumber may offer further opportunities, possibly utilising finger-jointing technologies.

Finally, the trade model was employed to assess Canada's vulnerability to losing the softwood lumber #3 market in the US. The result in this case is rather positive. Due to a drop in the price of Canadian softwood lumber #3 (as a result of eliminated demand in the US), Canadian exports to Japan, and to a lessor degree, Western Europe and "other importers" rise to almost offset lost sales to the US.

5.2.2 Premium Solid SPF Member

It is clear from the results of the study that a kiln-dried structural member is heavily favoured by builders and pre-cutters in post and beam construction. Among kiln-dry structural members there is a slight preference for solid sawn members rather than engineered structural members.

In the trade off analysis SPF faired very well. Although builders selected Sugi, Hemlock, and Scandinavian white wood above SPF, the market share scenarios placed SPF higher than actual market shares. This indicated that SPF has an opportunity to pick up market share.

It is pre-cutters who represent the greatest opportunity for a premium SPF product. SPF was chosen second behind Sugi as the most preferred species. As price increases SPF market share declined much slower than Hemlock or Scandinavian white wood. Further, as strength requirements increase SPF is chosen most often.

A premium SPF post would likely be well received by pre-cutters. Dry material is very stable for notching in the factory. Further, light coloured wood is traditionally used for posts. The usual cross section of posts are 105mm square, or 120mm square. Lengths are typically 3000mm for regular posts and 6000mm for two-storey posts.

5.2.2.1 Production Issues

As a means for adding credibility to the strength of these products there is the possibility of assigning a strength value to SPF posts through machine stress rating (MSR). Recently some Japanese sawmills have begun to MSR posts. Posts are labelled with both and modulus of elasticity value and a moisture content value. These are technologies that can be incorporated into Canadian mills.

5.2.2.2 Competitiveness Issues

While this product is not now produced for the Japanese market, if it were it would likely fall into softwood lumber category #2 or even #1.

Table 19 shows the production and domestic consumption of softwood lumber # 1 and #2 for all of the supply and demand regions as defined in this study. Aside from Canada, the only regions that have significant excess supply of softwood lumber #1 are the US and Scandinavia (.23 and .20, respectively, compared to Canada's .86 million cubic meters), and for softwood lumber #2 the US, Scandinavia and "other exporter" (1.04, .94 and .47, respectively, compared to Canada's .95 million cubic metres). Note, however, that while net importers, both Japan and Western Europe are large producers of these high-end, appearance grade softwood lumber categories.

In terms of competitive threats, then, scenarios need to focus on increased US, Scandinavian, Japanese or Western Europe supply of softwood lumber #1 and #2. Positive influences to Canada's position could include increased demand for these categories in Japan, Western Europe, or the US, with the latter two reducing competition from Scandinavia and the US.

Table 19 *1997 Production and Consumption of Softwood Lumber #1 and #2*

	SWL #1		SWL #2	
	Production	Consumption	Production	Consumption
Export Regions				
Canada	1.35	0.50	1.50	0.55
US exporter	0.68	0.46	3.14	2.10
Scandinavia	0.35	0.14	1.58	0.64
Baltics	0.00	0.00	0.00	0.00
Russia	0.00	0.00	0.00	0.00
NZ	0.24	0.16	0.30	0.20
Chile	0.07	0.04	.034	0.18
Other exporter	0.84	0.68	2.51	2.03
Import Regions				
US importer	0.01	0.01	0.20	0.40
Japan	1.35	1.98	3.29	4.81
W. Europe	0.86	1.54	1.73	3.08
Other importer	0.54	0.80	1.08	1.61

5.2.3 Dry Solid Hemlock Structural Beams and Posts.

Hemlock has a long tradition in the Japanese market. However, it has suffered as of late because of the shift to the use of kiln dried wood products in Japan. This trend is expected to continue with some industry experts in Japan speculating that new building standards will shift the entire market for wood products in Japan over to kiln dried material.

A kiln dried hemlock post has excellent potential in Japan. NLGA design values for visually graded Western Hemlock timbers are second only to Douglas-Fir/Larch. Strength was the most important attribute for wood structural members in the survey. In the trade off analysis increasing strength had a dramatic effect on the market share scenarios.

In this study hemlock was still a popular species with builders but the trend away from green material is clearly evident. This is largely due to the shift to pre-cutting wood structural members in the factory for post and beam starts. Further, it is expected that the new building standards law requiring a ten year warranty on structural framing will boost the use of KD material.

The ZAIRAI lumber partnership in British Columbia commissioned research into the properties of Hemlock compared to other species used in Japan on a variety of attributes. Hemlock performed favourably in these tests which were reported in a promotional booklet. The same booklet lists a total of 10 post and beam building components available from coastal Hemlock producers. Unfortunately, only five of the ten components are available kiln-dried.

Given the good strength values of Western Hemlock and the relative abundance of the species in the coastal resource it is recommended that further research efforts be made to develop a process to economically dry large dimension Western Hemlock.

The Hem-fir species group is currently marketed to Japan. There are currently calls for separating hemlock and amabilis fir. From a market perspective the most important reason is due to their different strength properties. Hemlock has higher strength properties than amabilis fir. As strength is the most important attribute for wood structural members it may be beneficial to species separate to improve the strength properties that Hemlock can offer the market. From a processing perspective there is the additional complication of the different drying characteristics between the species. Species separation of the hem-fir species group will be discussed below.

5.2.3.1 Production Issues

Drying
Drying large dimension hemlock economically for the Japanese market is the largest challenge for this product. Long drying schedules are required to yield a high quality product with acceptable levels of falldown. Minimum drying times that have achieved acceptable results were in the range of 10 to 15 days using vacuum steam technology. This technology would require investment by mills as it is not currently being widely used. There are other kiln drying technologies which can be considered including microwave and conventional drying.

Species Separation
Species separation raises several production issues. First, the most practical means of physical separation of the species must be devised. This could be in the forest, the log deck, or the mill. Second, once initial separation takes place there must be controls in place to keep the species separated throughout the production process. At the kiln optimal drying will take place when entire kiln charges are of one species or the other. This may provide logistical challenges.

Machine Stress Rating
Some sawmills in Japan have recently begun to stamp modulus of elasticity values on wood structural members. If hemlock were to be E-rated it would likely show values superior to Japanese species. Therefore, the acquisition of this production capability would be advantageous to the coastal industry.

5.2.3.2 Resource Issues

Significant volumes of hemlock and amabilis fir are present in the coastal resource. These species tend to grow together and thus are combined into a single commercial species group.

In general, hemlock has better strength properties than amabilis fir. Indeed, NLGA design values for visually graded timber afford higher values to western hemlock than for the hem-fir species group (Table 20).

Table 20 NLGA Design Values for Visually Hem-fir Timbers

Species and Commercial Grade	Size Classification	Bending (psi)	Tension Parallel to Grain (psi)	Shear Parallel to Grain (psi)	Compression Perpendicular to Grain (psi)	Compression Parallel to Grain (psi)	Modulus of Elasticity ($x10^6$ psi)
Hem-Fir							
Select Structural	Beams and Stringers	1250	725	70	370	900	1.3
No.1		1000	500	70	370	750	1.3
No.2		675	325	70	370	425	1.1
Select Structural	Posts and Timbers	1150	775	70	370	950	1.3
No.1		925	625	70	370	850	1.3
No.2		550	375	70	370	575	1.1
Western Hemlock							
Select Structural	Beams and Stringers	1400	825	70	410	1000	1.4
No.1		1150	575	70	410	850	1.4
No.2		750	375	70	410	550	1.1
Select Structural	Posts and Timbers	1300	875	70	410	1100	1.4
No.1		1050	700	70	410	950	1.4
No.2		650	425	70	410	650	1.1

Source: 1997 National Design Standards

Whereas hemlock has superior strength properties, amabilis fir is easier to dry and to treat. When dried in mixed charges this means that any kiln schedule is a compromise between the two species. This can result in inconsistent moisture content and increased falldown due to drying defects.

5.2.3.3 Competitiveness Issues

Traditionally the Japanese have preferred light colours for posts and darker colours for beams. This has been changing with the move to kiln dry material and engineered wood. Scandinavian whitewood glulam is now accepted in horizontal as well as vertical application. As solid wood is actually preferred over engineered wood solid hemlock beams may find a market. For posts there is little doubt that a kiln dry hemlock post would fair well in the market. The question that remains, of course, is weather or not a dried hemlock post can compete on price (noting the added cost of hem-fir species separation, drying large dimensions and the associated falldown).

5.2.4 Borate Treated Lumber

Most housing starts in Japan are in areas of moderate to high risk of termite damage. The Ministry of construction recommends that any wood member within 1 metre of ground contact be treated with wood preservative, painted, or naturally durable. For GHLC loans this treatment is required.

Treatment is often achieved through spraying once the framework of a structure is built. This type of treatment emits volatile organic compounds (VOC's) which does not fit well with the concept of 'healthy house'. In follow-up visits with builders in 1999, it was found that there is a trend towards declining GHLC subsidised mortgages in order to forgo spray treatments.

Borate treatment is one of the possible ways to meet this GHLC requirement without introducing chemicals which may be detrimental to health. Borates provide resistance to insect attack and decay while having no ill effect on humans.

It is proposed that borate treated lumber may be a viable product opportunity in Japan. This would impact any wood used within 1 metre of ground contact, primarily dimension lumber used in 2x4 homes and posts used in post and beam homes.

5.2.4.1 Production Issues

The borate treatment of lumber can be achieved using standard pressure treating facilities. Wood is treated with a solution of boric acid. After treatment further diffusion of borate can take place in the yard prior to drying.

Borates are not expected to have any effect on the drying characteristics of lumber. However, by treating wood prior to drying, drying related defects will not appear until significant value is added to the wood. Some method of selecting lumber for borate treatment which is most likely to dry without defect is advisable.

5.2.4.2 Resource Issues

The most promising species for borate treatment are amabilis fir from the coast and alpine fir from the interior resource. Both of these species are easily treatable.

5.2.4.3 Codes and Standards

As healthy house grows in importance the market for borate treated wood may expand. In a recent interview in Japan the trend of consumers opting out of GHLC financing to forego chemical treatment of wood was brought to the attention of the research team. If borate treatment were accepted by the GHLC the market for these products would greatly expand.

At the current time borate is not an accepted treatment by the GHLC. The GHLC relies on the Japan Wood Preservers Association (JWPA) list of preservative for their requirements. At the current time the JWPA has 2 requirements of treated wood. The first is a wash test and the second a ground contact stake test. As borates will leach in the presence of liquid water they do not pass these two tests. What is not taken into account in the JWPA standards is the exposure risk of treated wood. For treated framing lumber there should be no in-service exposure to liquid water. This issue must be addressed to access this market.

5.2.5 Borate Treated Dodai

Until recently, CCA treated hemlock held most of the market for dodai (sill plates), for low and mid-range home construction in Japan. Due to environmental restrictions this treatment has virtually disappeared. Alternative treatments such as ACQ and CuAZ have appeared in the market for hemlock dodai. In addition, the use of naturally durable species has increased.

Builders are faced with two extremes in the market for durable dodai. Naturally durable species are expensive to build with while chemically treated wood runs contrary to the concept of healthy house.

Borates provide durability against insect attack and decay without the health issues of traditional chemical treatments, or the cost of naturally durable species. However, they are not currently approved for use in dodai applications in Japan. This is because borate can leach out of wood when exposed to running water. Although dodai are not exposed to running water or ground exposure the test for dodai materials is a ground test where leaching is a concern. The possibility of approval of a borate treated dodai is being explored by Forintek Canada Corp.

5.2.5.1 Production Issues

See 5.2.4.1

5.2.5.2 Resource Issues

See 5.2.4.2

5.2.5.3 Codes and Standards

The codes and standards issues for a borate treated dodai are similar to 5.2.4.3 above. However, in this application it may be even more difficult to get approval for borate treatment. This is because the dodai is considered to be in direct ground contact. In actual fact the dodai is not in ground contact, nor should it ever see direct exposure to water.

6 Engineered Structural Members

Major tends and opportunities in engineered structural members include:

- Increased demand for glulam, driven by the move to pre-cut wood components for post & beam homes (a less expensive alternative to large dimension solid kiln dried wood); performance connotations of glulam
- Specific opportunities for
    - Borate Treated Glulam,
    - Borate Treated Lamstock,
    - Bark Board Dodai,
    - Hemlock LVL,

as well as expanded glulam and/or lamstock of most Canadian species.

6.1 Attributes Demanded in Japan

The specifier groups surveyed for the engineered structural members portion of the study were builders and pre-cutters. In general pre-cutters had a greater degree of experience with these engineered products.

6.1.1 Survey Question Results.

The relative importance of product attributes were quite similar for pre-cutters and builders (Table 21). Strength, price stability and durability were the most important attributes for both groups. Country of origin for material and the Japanese source of distribution for material are of little importance to pre-cutters as well as builders.

Table 21 ***Pre-cutters' Most Important Attributes for ESPs***

Attribute	Pre-cutters' Rank	Builders' Rank
strength	1	1
price stability	2	3
durability	3	2
security of supply	4	5
species	5	6
distributor	6	N/A
connections	7	4
treatability	8	8
source of material	9	9
country of manufacture	10	10
supply reliability	N/A	7

Respondents were also asked where in a tradition post and beam home they used, consider using, and expect to use engineered structural products (ESPs). In general, pre-cutters have used and expect to use ESPs to a higher degree than builders (Table 22). This follows pre-cutters' preference for kiln-dry material. The greatest use of engineered structural members by both groups is for post applications and beam applications. Solid wood will continue to be used for joists, joist beams, studs, and dodai.

Table 22 Builders and Pre-cutters Use of ESPs

Builders (n=79) and Pre-cutters (n=111) usage by percentage								
	have used		have considered		expect to use		do not expect to use	
	B	*P*	B	*P*	B	*P*	B	*P*
foundation itself	12.7%	*29.7*	19.0	*25.2*	22.8	*25.2*	64.6	*45.0*
hari (upper level beams)	62.0	*91.9*	24.1	*4.5*	24.1	*4.5*	13.9	*3.6*
keta (beam)	46.8	*84.7*	22.8	*6.3*	15.2	*5.4*	38.0	*9.9*
obiki (joist beam)	15.2	*22.5*	32.9	*26.1*	19.0	*25.2*	65.8	*52.3*
neda (joist)	13.9	*21.6*	29.1	*29.7*	19.0	*23.4*	67.1	*55.0*
kanbashira (posts)	54.4	*93.7*	20.3	*3.6*	12.7	*1.8*	32.9	*4.5*
toshibashira	36.7	*92.8*	25.3	*5.4*	10.1	*0.9*	53.2	*6.3*
taruki	10.1	*15.3*	25.3	*32.4*	16.5	*22.5*	73.4	*62.2*
mabashira (stud)	30.4	*76.6*	25.3	*9.9*	16.5	*4.5*	53.2	*18.9*
B= Builder *P=Pre-cutter*								

6.1.2 Conjoint Analysis Results

Price

Almost half of the builders selected price levels that were the same as solid wood. There was little willingness expressed by builders or pre-cutters to select a price more than 20% greater than solid wood prices. This indicates that the preference for ESPs will not withstand substantial price differentials from solid wood. Few builders are willing to pay any premium for Japanese or Canadian hemlock ESP's. Premiums are most likely to be paid for Douglas fir and European 'white wood'.

Price Stability

In general price seems more important than price stability. However, price stability remains important. Over half of the builders select a price that would be stable for at least six months. Conversely less than a quarter selected a price which fluctuated as much as solid wood. This suggests that price stability is one of the key characteristics of ESPs.

Pre-cutters want price stability with small but significant increases in selection of a product as price stability increased. Over three-quarters of respondents preferred stable prices for at least 3 months.

Strength

Strength is one of the highest ranked attributes by builders. There are significant segments of builders preferring products that are stronger than existing code. As strength properties increase Douglas fir is

selected more frequently, and Canadian hemlock, along with other offshore species are selected least frequently.

Pre-cutters are interested in ESPs that are slightly or moderately stronger than code and few select much stronger than code. Given the importance of strength in the attribute ranking, over 60% of pre-cutters indicate an interest in a stronger structural member. *ESPs that are much stronger than code could command a premium of 20-40% in this niche market.*

Connections
Connectors which use steel or steel combined with traditional joinery are selected by over two thirds of the builders. Less than a third of the builders select traditional connectors (notches). This indicates a willingness to shift from more traditional connections to newer, more engineered connections, particularly if they incorporate some link to traditional notching. All types of connections are very price sensitive with a steep drop in popularity as price increases. Connections that use a combination of steel and traditional notching are least effected by a price premium. This indicates that builders want to try new connection and are somewhat willing to pay a premium as long as the new connections incorporate some form of traditional notching.

Similar to builders, pre-cutters prefer a combination of traditional connections and steel, followed by traditional notching with bracing and lastly, steel connectors. However there are substantial numbers that selected each of the three methods of connecting members. It is clear that a combination of traditional notches with additional support from bracing or steel connectors is the most popular method of connecting ESPs.

Availability
Pre-cutters prefer some security in availability with 85% preferring availability all year with no more than a 6-week delay from order to delivery. Consistent supply of ESPs is critical for pre-cutters. Almost two-thirds of respondents select a three-week delay or less indicating a need for either warehousing in Japan or very good logistics and transportation. Preference for European white wood dropped precipitously if it is only available at certain times of the year while other wood preferences maintained relatively stable under this constraint.

Source of Wood
While there are significant differences between the selections in source of wood, the actual numbers of pre-cutters selecting each source was relatively even. The least favoured wood for ESPs is Canadian hemlock followed by European white wood. The most favoured source is Douglas fir. If premiums are to be paid then they will be for Douglas fir and to lesser extent Japanese wood. Selection of Canadian hemlock drops dramatically once any price premium is considered.

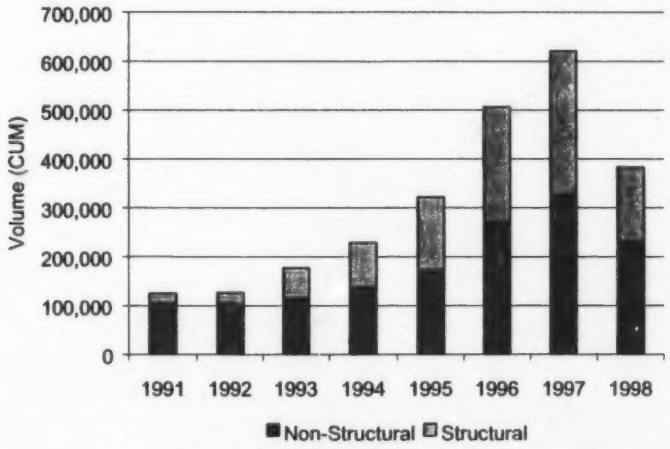
6.1.3 Japanese Demand For Engineered Structural Members.

Japan has annual wood housing starts between 600,000 and 700,000 units. In Figure 5, notice that the majority of these wood starts are post and beam which is a heavy user or solid and engineered wood timbers.

Through the 1990s production of glulam in Japan has increased from 200 MMBF in 1990 to over 300 MMBF in 1997. However, over the same time period Japanese imports of glulam increased even more

rapidly. Figure 27. indicates that total Japanese consumption of glulam has more than doubled in the 1990s.

Laminated lumber in Japan is divided into two key markets. These are structural and non-structural. Structural glulam is used for load bearing members of structures. These products must meet certain standards for glue bond performance, bending strength, number of laminations, and wood quality. Non-structural glulam is termed 'laminated lumber for fixtures'. These members may be grooved or worked and are used primarily for interior fixtures. Standards for non-structural glulam are less demanding from a structural perspective, however, wood quality and finishing are still very important.

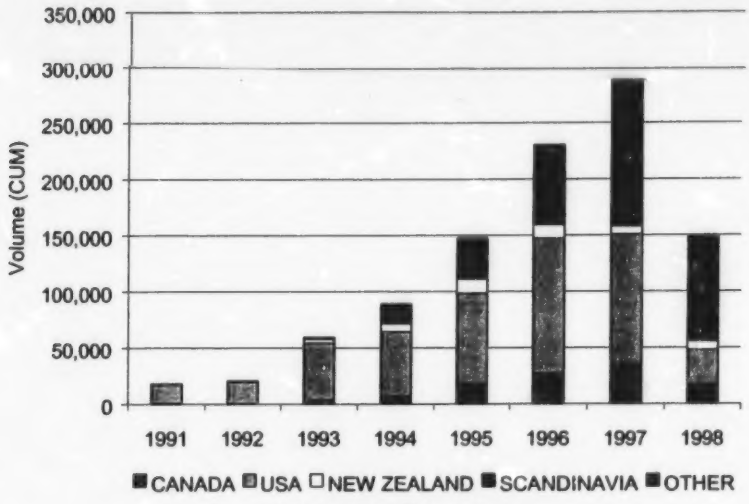


Source: Japan Tariff Association

Figure 27 Imports of Laminated Lumber by Type

Imports of both structural and non-structural laminated lumber have increased in the 1990s. However, it is structural glulam that has seen the greatest growth with growth from 17,000 m^3 in 1991 to 290,000 m^3 in 1997.

The increase of imports of structural glulam into Japan has been spread across all suppliers. At the peak in 1997 the US, Scandinavia, and Canada were the largest exporters of structural glulam to Japan with volumes from Austria, Germany, Russia, and New Zealand growing as well. In the market contraction of 1998 it was the large suppliers which suffered the greatest volume losses. In the same period Russia, Austria and Germany not only increased their market shares, but their volumes of structural laminated lumber shipments to Japan as well.



Source: Japan Tariff Association

Figure 28 Origin of Japanese Structural Glulam Import

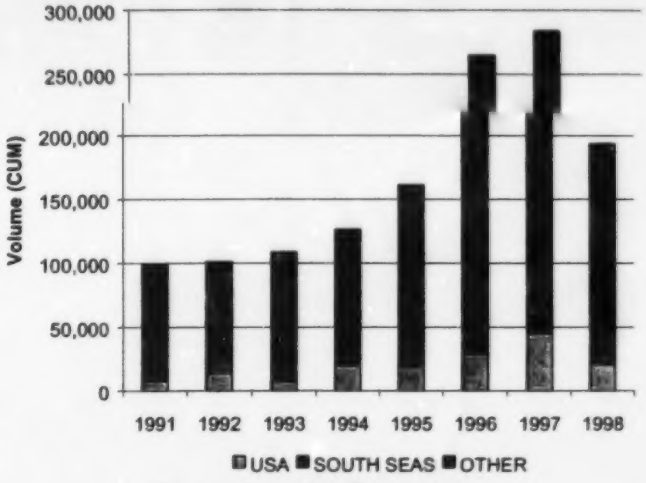
Table 23 points at some of the major shifts in market share brought about by the recovery of the Japanese market.

Table 23 Glulam Imports in 1st Half of 1999

Country	Volume (m^3)	Change 99/98 Jan-Jun
U.S.A.	22,013	38.2%
Austria	19,607	100.4%
Sweden	18,473	108.1%
Finland	13,913	195.8%
Russia	13,364	19.3%
Germany	12,001	338.8%
Canada	11,586	59.7%
New Zealand	4,817	116.9%
China	2,666	88.1%
Other	2,173	---
TOTAL	120,617	78.5%

Source: Japan Lumber Reports; Aug. 27, 1999

Imports of non-structural laminated lumber are similar in volume to structural glulam. However, the players in this market are very different. South Seas countries are the primary source of non-structural laminated lumber imports to Japan. The US is the only other large player with volumes similar to their structural glulam volumes.



Source: Japan Tariff Association

Figure 29 Non-structural Glulam Imports

6.2 Discussion of Attributes Supplied by British Columbia

6.2.1 Resource

See Section 5.1.4.

6.2.2 Infrastructure and Technology

The Canadian glulam industry is quite small with only 7 producers, 4 of which are in British Columbia. In 1997 production of glulam in Canada was 15 MMBF with the largest plant producing approximately 6 MMBF. To put this into perspective the US produces 300 MMBF annually from 33 plants (APA- the Engineered Wood Association).

British Columbia is a supplier of lamstock to both the US and Japan. However, these numbers cannot be separated from the total production and trade of softwood lumber in the statistics.

There are other engineered wood products produced in Canada. Canada has three LVL plants, one PSL plant, and 14 I-joist plants. British Columbia has a PSL plant, an LVL plant, and three I-joist plants as well as a new LVL/OSB/I-joist plant just announced.

6.2.3 General Competitive Position

Given Japan's large capacity for glulam production, and the likelihood of continued subsidisation of Japanese domestic production, BC/Canada will need to focus on the export of lamstock. See Section 5.2.1.3 for a description of the competitive position of this product.

However, in the case of borate treated glulam, export of the engineered product is possible as the technology would be Canadian.

6.2.4 Linking Supply and Demand

Four opportunities were identified for engineered structural members in the linkage analysis. These were;

1. Borate Treated Glulam,
2. Borate Treated Lamstock,
3. Bark Board Dodai,
4. Hemlock LVL.

6.2.5 Borate Treated Glulam

Resistance to decay and insect attack is an important aspect of wood durability in Japan. Durability was the third highest rated attribute demanded for engineered structural members for both builders and pre-cutters. This is due to Japan's moist environment and its termite infestation problems. All but the northernmost tip of Japan is subject to termite damage. The densely populated southern regions of Japan suffer from a very aggressive type of termite, the subterranean Formosan termite.

All wood within one metre of the ground must be treated or painted in a Japanese home to receive GHLC financing. However, there a reports of home buyers opting out of GHLC financing in order to avoid the use of chemical treatments in the home. This presents an opportunity for a 'healthy' termite resistant product such as borate treated glulam.

6.2.5.1 Production Issues

Scientists at Forintek Canada Corp. have explored the possibility of a borate treated glulam product. It would involve the treatment of green lamstock, drying, planing, then lastly glulam lay-up. The treatment of relatively small dimension lamstock would ensure fuller penetration of the wood preservative and less time for to preservative diffusion into the wood.

The technical hurdle of meeting bond strength standards has been partially addressed with a method for bonding borate treated lamstock with phenol-resorcinol resin at elevated temperatures. However, at present there are no glulam facilities in Canada capable of elevated temperature glue-line curing. Work on reducing curing to ambient temperature is part of the 2000/2001 Forintek national research program. However, given the small size of the Canadian industry an investment in this product could likely involve capacity additions which could include a radio-frequency press.

The production process for borate treated glulam would be as follows:

1. Rough saw lamstock
2. Borate treatment in pressure vessel
3. Kiln dry
4. Surface preparation (planing and edging)
5. Grade
6. Glulam lay-up and pressing

One of the risks in treating lamstock prior to kiln drying it is the drying related falldown. As falldown will already have been treated value will have been added that cannot be recovered. In addition, there is the issue of disposing with treated wood dust and shavings.

6.2.5.2 Resource Issues

There are several species and species groups which could be used in the manufacture of treated glulam. The Hem-fir species group was the initial focus of the FCC project. The amabilis fir in this group is easier to treat, however, it has lower strength values that western hemlock. Western hemlock is also easy to treat but is difficult to dry and is associated with higher drying related falldown. Hemlock and amabilis fir would be appropriate for post applications. The other coastal species which could be used is Douglas-fir. This species is very strong but difficult to treat. In addition, Douglas fir is used mostly for beams, which tend to fall outside of the one metre treatment zone.

From the interior resource lodgepole pine is being considered for termite resistant glulam. It is relatively easy to treat and has the highest strength properties of the pine species in BC.

6.2.5.3 Market Access Issues

JAS sets out product and manufacturing standards for structural and non-structural glulam. To manufacture glulam for the Japanese market a mill would have to seek JAS certification.

JAS certification would open up the market for this product as GHLC uses JAS as a guide to its own product lists. However, JAS standards do not cover the durability of the product. It is the acceptance of borate as an alternative for the suggested one metre treatment that will create a market for borate treated glulam.

Tariff on glulam (4418.90) = 3.9%

6.2.5.4 Competitiveness Issues

In the first half of 1998 Japanese imports of glulam were down 64.7% from the same period in 1997 (FAS, 1998). Table 23 displays the 1999 market recovery. While imports from the US were up 38% from 1998 the imports from Germany, Austria, Finland and Sweden were all up over 100% from 1998 volumes. This indicates that Europe is positioned to be one of the leading competitors for structural glulam in the future.

There are no full penetration treated glulam products on the Japanese market. Glulam is very rarely treated in a pressure vessel after manufacture due to the risk of defects and the difficulty of attaining full penetration. The competition for a borate treated glulam product will come from untreated glulam and solid wood which can be painted or surface treated for protection. Fully treated glulam, or solid wood for that matter, will perform better than painting or surface treatments. However, the market research into the size of the premium available for this increase in performance must be performed.

6.2.6 Production of Lamstock

Also covered in Section 5.2.1

There are two ways in which value can be added to lamstock for export to Japan. The first opportunity to add value to lamstock destined for Japan is to treat it with borates. Borates provide protection from decay and insect attack, which Japan is particularly susceptible to. The second value added product is a machine-stress-rated laminate for tension faces of glulam beams. By stress rating lamstock onshore a greater value may be achieved for selected pieces.

Figure 23 displays Japanese production and imports of glulam. Both production and imports rose sharply between 1992 and 1997. This indicates that even with additions to capacity Japan could not produce enough glulam for its needs. At the time of writing 1998 data was not available. However, it is expected that the imports of glulam will have dropped considerably due to Asian economic conditions. On the other hand, we would not expect to see domestic production drop off as dramatically in 1998 as there is always a tendency to source domestically before importing. As Japan has built up significant glulam manufacturing capacity, without a large domestic wood supply to back it lamstock is a promising product for the Japanese market which may be less susceptible to demand shocks such as was seen in 1998.

6.2.7 Borate-treated Lamstock

Recent work at Forintek Canada Corp. looked into the feasibility of laminating borate treated stock. It was found that borate treated lamstock can be adequately bonded with Phenol-Resorcinol-Formaldehyde (PRF) resins in the presence of added heat. At this time the Canadian glulam industry does not have the capability to cure glulam adhesives with heat, making this a technology we cannot currently use. However, the Japanese glulam industry is capable of heating glue lines and, therefore, could manufacture borate treated glulam from Canadian lamstock.

Borate treated lamstock would most likely be used in posts as it is these vertical members that are most likely to be present within 1 metre of the ground where treatment is desirable. The post industry is very competitive. Demand is driven by price and whether a member is kiln dry. Laminated lumber is used up to 60% of the time by major home builders. This laminated lumber currently is coming to Japan from Europe in the form of lamstock and finished products.

Table 24 Structural Components Used By Major Wooden Home Builders

	Species	Percent
Posts	Laminated Lumber	60.8%
	Sugi	17.6%
	Hinoki	10.9%
	Hemlock	4.2%
	Other	6.4%

Source: Japan Forest Products Journal

Estimates of the potential market for borate treated glulam in Japan are between 20 million and 105 million board feet (Ni et al., 1999).

6.2.7.1 Production Issues

The first step to producing borate treated lamstock is to saw for lamstock dimensions. Final dimensions after treatment, drying and surfacing must be 22mm x 107mm for posts. Mills must have the flexibility to saw and sort this dimension while producing other lumber dimensions and grades. Although 22mm thickness is conventionally used in Japan JAS rules have been changed to allow for different lamina thickness' as long as all lamina in a post are relatively the same thickness. It may be advisable to produce a different lamina configuration to minimise falldown. Before treating some method of grading and sorting lamstock must be implemented to ensure that only boards which are likely to treat and dry without defect enter the process. In this way the value of treating wasted in unused stock can be minimised.

Factors considered for lamstock quality are strength, knots and holes, grain inclination, decay, splits, discoloration, rough grain, width of annual rings, moisture content, and planing tolerances.

6.2.7.2 Resource Issues

JAS standards for laminated lumber specify six groups of species by strength. Included in these groups are Douglas fir, lodgepole pine, ponderosa pine, larch, hemlock, and yellow cedar. The list is not exclusive. Any species meeting the strength properties of one of the six groups can be included in that group. Perhaps the most appropriate species on this list for borate treatment is lodgepole pine.

6.2.7.3 Competitiveness Issues

Scandinavia currently exports significant quantities of whitewood lamina to Japan for the production of posts. The September 24, 1999 edition of Japan Lumber Reports lists 22x107mm S4S whitewood lamina as trading for 44,000 yen per cubic metre.

6.2.8 Bark Board Dodai

Forintek scientiss have developed a bark-based panel that is extremely resistant to moisture, decay, and insect attack. These properties make the material very suitable to the adverse conditions wood products can face in Japan.

Currently there is void in the market for a low-cost dodai product in Japan. Whereas dodai in low to mid-ranged homes were made of CCA treated solid wood, this product is no longer used due to environment considerations. Bark board requires no artificial resins or preservatives. Further, material costs are potentially quite low as the furnish is a residual currently being burned or landfilled. A bark board dodai could be positioned to capture the low to mid range of the market.

6.2.8.1 Production Issues

Bark board can be manufactured in much the same way as other panels. Stock is prepared by hammer-milling bark. Pressing would take place at pressures similar to OSB and particleboard. However, bark board requires somewhat higher temperature pressing than other panels. The equipment for the production of bark board has not yet been developed at a commercial scale.

To be used as a sill plate, the barkboard panels would have to be glued into the required dimensions (see Figure 30).

Traditionally, Japanese carpenters use mortis and tenon joinery on their sill plates as they do with posts and beams (including such joinery between the sill plates and the posts). This is illustrated in Figure 31. This may pose a problem for barkboard, which does not have high machining properties. However, there are an increasing number of "hybrid" post and beam homes being built that utilise metal connectors instead of elaborate joinery (see Figure 32).

A final product issue is barkboard's heavy weight. With a specific gravity approaching 0.9, a barkboard glulam product would be expensive to ship and difficult to handle in construction. One possible solution would be to use a combination of barkboard and yellow cedar, as illustrated in Figure 33. This would not only make the product lighter in weight, it would also allow for traditional joinery.

6.2.8.2 Resource Issues

Results to tests thus far have indicated that species of bark will not be a limiting factor for this product. Spruce, lodgepole pine, Douglas-fir, balsam fir, Jack pine, western hemlock, western red cedar, and aspen bark have each been tested with success in producing bark board.

There are approximately 12 million bone dry tonnes of bark produced in Canada per year, 5-6 million of which is produced in British Columbia.

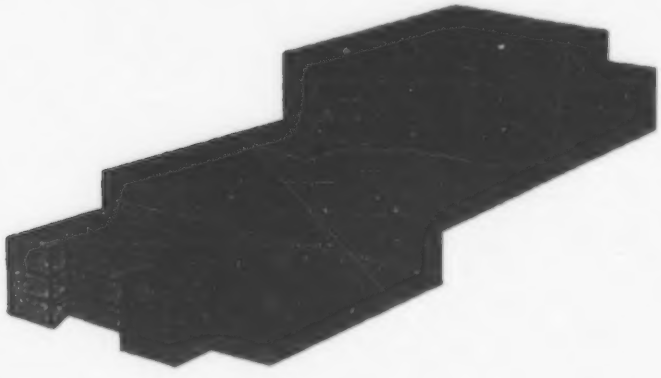


Figure 30 Barkboard Glulam Sill Plate

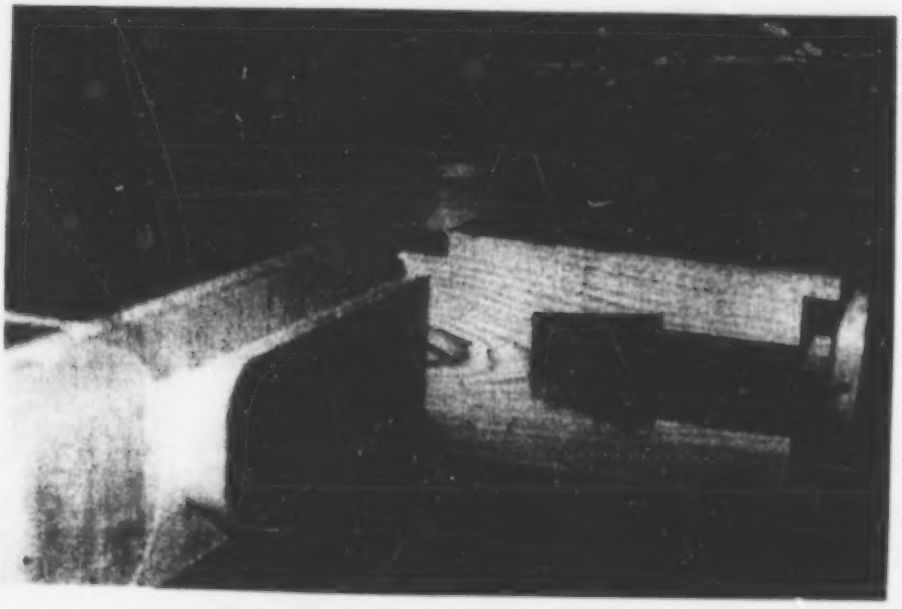


Figure 31 Example of Japanese Joinery

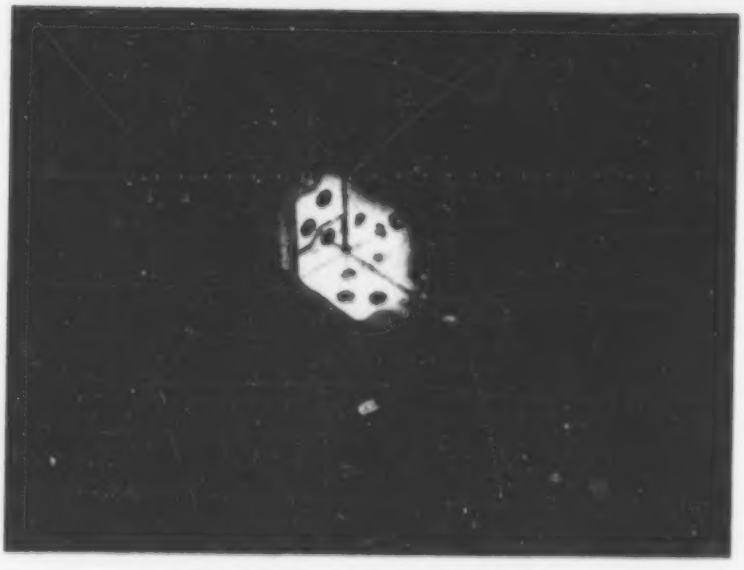


Figure 32 "Hybrid" Sill Plates

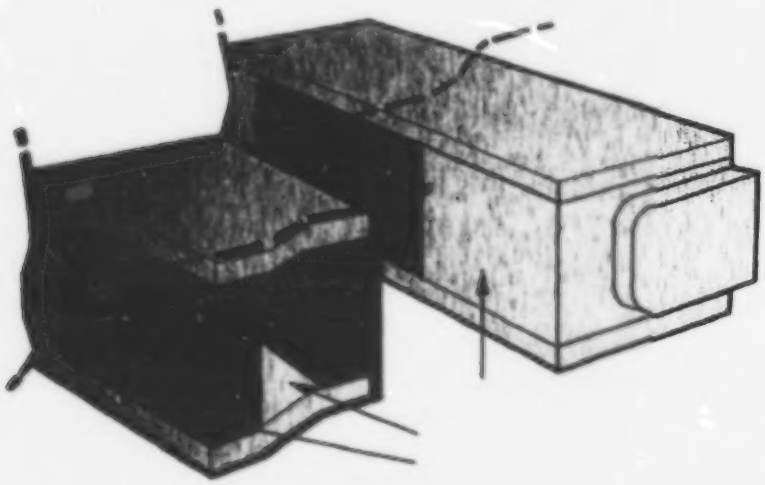


Figure 33 Engineered Barkboard/Solid Wood Sill Plate

6.2.8.3 Market Access Issues

A barkboard product would likely enter Japan a proprietary product under Section 38 (or the new Section 68) of the Building Standard Law.

Tariff = 6.0% (particleboard 4410.11)
Tariff = 3.9% (glulam 4418.90)

6.2.8.4 Competitiveness Issues

Bark board has an initial advantage from having very low furnish costs. Bark residue is often a burden on mills that must pay to landfill. Therefore, the cost of furnish initially may only be transportation and handling of the bark. However, if the production capacity of bark board grows there is the potential for price competition for bark.

Bark board does not contain any glues or preservatives. It is a self curing and naturally durable product. These are positive attributes in the Japanese market as there have been recent backlashes against chemicals used for gluing and treating.

One of the potential drawbacks to barkboard is its weight. At a specific gravity around 0.9 it is a difficult material to handle by hand.

Competitive products:
- Treated hem-fir solid wood
- other species chemical treated
- naturally durable species
- Steel

6.2.9 Hemlock Laminated Veneer Lumber

No market numbers currently exist for the use of laminated veneer lumber in Japan nor was LVL considered in the engineered structural members study. However, given the openness of Japanese builders and pre-cutters to engineered wood it is worth looking at the potential for exporting LVL to Japan.

LVL has been incorporated into the North American platform frame construction method. With platform frame starts likely to approach 100,000 in the next decade engineered wood products such as LVL may soon become bigger players in the Japanese market. Strength was rated as the most important attribute for engineered structural members, an attribute that LVL excels in.

LVL can be produced from a variety of softwood and hardwood species depending on strength. It is proposed here that hemlock be investigated as a possible species for LVL production in British Columbia. Hemlock has strength properties just below that of Douglas-fir and is plentiful in the coastal region. hemlock is typically difficult to dry and veneering it may be an effective solution.

6.2.9.1 Competitiveness Issues

There are a handful of domestic Japanese producers of LVL produced 153,000 cubic meters of LVL in the 1997 fiscal year. In the same period imports were 60,000 cubic meters (FAS 1998). Total market demand for LVL in JFY1997 was down 15% from the previous year due to the Asian slowdown.

Current Japanese producers of LVL lack the economies of scale and the ability to expand to make LVL (FAS 1998). This presents foreign producers of LVL with a potential market. However, acceptance of LVL in the Japanese market is not near what it is in North America. Any exporter of LVL to Japan might have to invest considerable efforts in market development.

7 Japanese Furniture Markets

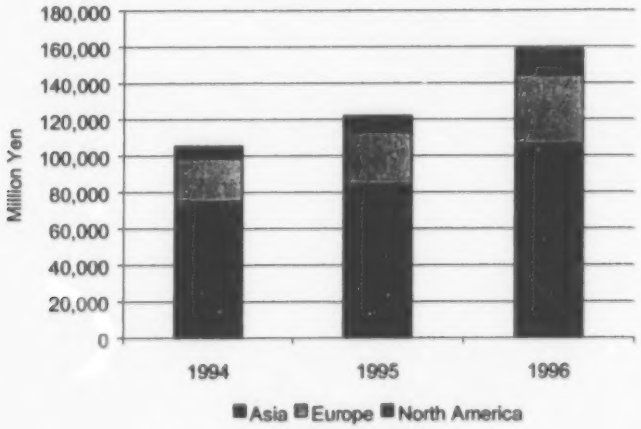
The major trends and opportunities for wooden furniture include:

- growing demand for lighter colours and North American styles have created opportunities for Canadian softwood furniture in addition to hardwood
- opportunity for value-added; style and durability drive demand, NOT price.

7.1 Imports

Japanese imports of furniture increased fourfold between 1985 and 1995. In 1995 Japanese imports of furniture totalled 184.6 billion yen or $2.64 billion (DFAIT). About 80% of this value is finished furniture as opposed to furniture parts and upholstered auto parts. Wooden furniture represented about 65% of furniture imports in 1995.

Figure 34 displays the import of wooden furniture by origin. In the three years displayed the import of wood furniture showed increased imports from all regions. Asia remains the largest exporter of wooden furniture with Thailand being the largest (Table 25). Italy is the top European exporter and the US the top North American exporter.



Source: JETRO, 1998

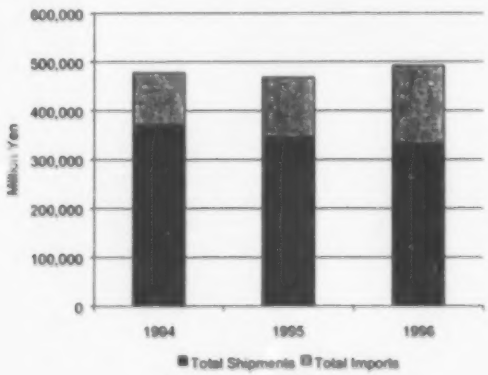
Figure 34 Japan Wooden Furniture Imports by Origin

Table 25 Japanese Imports of Wooden Furniture by Country

Units = Million Yen			
	1994	1995	1996
China	8,590	11,959	16,909
Taiwan	13,509	13,309	16,849
Thailand	23,955	25,154	28,145
Malaysia	8,319	11,694	16,626
Indonesia	10,264	11,624	14,882
Other Asia	10,587	10,900	13,247
Denmark	1,674	2,699	3,526
England	2,245	2,409	3,292
Netherlands	1,887	1,928	2,529
Spain	1,821	2,293	3,309
Italy	9,737	11,408	15,812
Other Europe	5,836	7,346	8,935
U.S.A.	6,527	7,972	12,365
Other NA	505	1,305	2,287
Other World	306	554	1,130

Source: JETRO

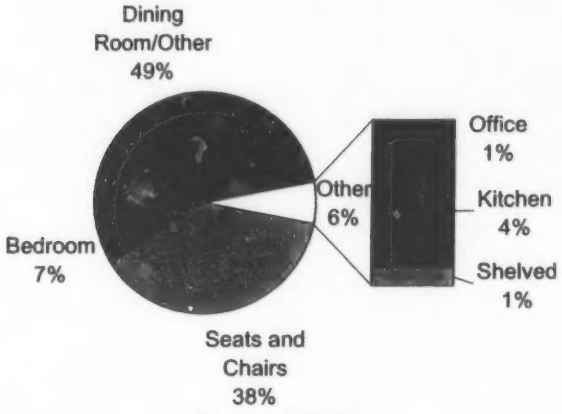
While imports are going up in Japan the market for wooden furniture is not necessarily expanding. Much of the increase in wooden furniture imports from Asian countries is from Japanese companies moving production offshore. Figure 35 shows that the increase in imports between 1994 and 1996 was roughly equalled by a corresponding decrease in domestic shipments. There are those in Japan that do not expect the Japanese market to increase for furniture as the introductory growth period of non-traditional pieces such as beds and dining room sets is over.



Source: JETRO

Figure 35 Japanese Shipments and Imports of Wooden Furniture

Japanese wooden imports are dominated by household furniture rather than office furniture. Furniture for the dining room and living room are the largest imports.

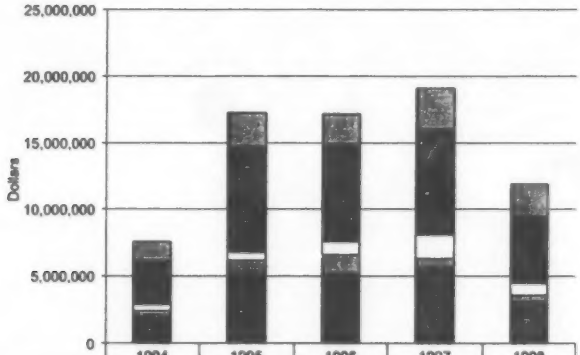


Source: JETRO

Figure 36 1996 Wooden Furniture Imports by Type

Imports from Canada

Imports from Canada make up less than 1% of all Japanese furniture imports. Figure 37 displays the types of furniture exported to Japan by Canada. In 1998 household furniture made up 38% of exports, office furniture 42%, and institutional furniture 20%.



	1994	1995	1996	1997	1998
Institutional	1,403,005	2,531,269	2,235,326	3,014,619	2,404,722
Other Office	2,118,318	5,367,828	5,326,237	5,701,997	3,124,820
Metal Office	1,167,000	2,597,000	1,998,000	2,257,000	1,875,000
Other Household	480,873	576,892	968,783	1,757,621	891,031
Household Upholsered	306,809	822,280	1,297,960	640,382	462,149
Household Wooden	2,118,318	5,367,828	5,326,237	5,701,997	3,124,820

Source: Strategis (Industry Canada)

Figure 37 Canadian Furniture Exports to Japan.

7.2 Furniture Segments

The market for furniture in Japan can be broken down in three ways. Furniture markets can be characterised by end-use, material, and order type.

Table 26 Furniture Decision Matrix

End-Use	Material	Order
Household	Wood	Ready Made Furniture
Office/Institutional	Metal	Semi-Order Made
	Other	Order Made

7.2.1 End-use

7.2.1.1 Household Furniture

Household furniture is the largest end-use segment in Japan. Household furniture accounts for approximately 65-70% of demand for furniture in Japan (USDOC, 1995). Traditional wooden household furniture pieces were chests and desks of Japanese style. This style is highly ornate with a dark finish. With the influence of a western lifestyle and the trend to 'getting off the floor' the Japanese now demand a wider variety and greater quantities of household furniture. This includes bedroom and dining room suites, sofas and other items. This demand for a wider range of furniture pieces also opened up Japan to a wider range of furniture styles.

In 1962 only 6.2% of households had dining room sets as compared with 69.7% in 1992 (JETRO). Living room sets were present in 36.3% of homes in 1995, a figure which has not moved much in the past 20 years. In light of these statistics it is believed that the expansion of the Japanese household furniture market is over. However, demand is will continue at a stable level as furniture will be purchased and replaced in much the same fashion as in North America.

Demand Factors
Household furniture is often purchased in conjunction with major life events in Japan. These include marriage, birth of a child, school entrance, and the move into a new or renovated house.

The "bridal furniture" segment is traditionally of great importance to the Japanese furniture market. In preparing for a new life brides and their families purchase large furniture sets for the bedroom and even the dining room and living room. This tradition has changed in some ways but remains an important demand driver. Couples now excerpt more control on the selection of furniture, and are opting for western styles more often. In addition, there is a growing preference to buy furniture in pieces over time rather than sets at the time of marriage.

A 1996 market study of married couples, singles, and couples in arranged marriages identified some of the trends in household furniture demand (de Boer and Kosoy, 1997). Couples in arranged marriages were more traditional. They were more likely to believe that the purchase of marriage sets were still commonplace. However, they were still strong believers in buying furniture piece by piece over time and felt the least constrained by space for furniture. Singles were the most likely to read furniture advertisements. They were also more likely to believe furniture is not for long term use. The outcome

that most stood out for couples was that they believed much more strongly than others in buying furniture at department stores rather than furniture stores.

Another demand factor to consider in Japan is the large demographic group born in the 1970's to post WWII parents. This demographic is currently working its way though the life events above individually and with their families. In addition, there may exist opportunities for seniors furniture as the parents of this demographic age and move into new dwellings.

Styles
The styles of household furniture in Japan can generally be linked back to the country of origin. Table 27 displays the Japanese consumer image of furniture from major exporters.

Table 27 Consumer Image of Imported Furniture

Country	Comments
Italy	Elegant, Classic European, Affordable
Germany	Quality and Performance, High Price
Scandinavia	Simple, Modern, Unfinished
United States	Continental Casual, Affordable
Taiwan	Export oriented, switching from US to Japan
Republic of Korea	Similar to Taiwan and Singapore
Singapore	Scandinavian Design, high tech production
Indonesia	Rattan Furniture
Thailand	Mass Market Rubberwood Furniture
Canada	Unknown in Japan

Adapted from de Boer and Kosoy, 1997

Quality
Quality is a very important furniture attribute in Japan. Unlike American consumers the Japanese expect all surfaces of a furniture piece to be finished, no matter if it is visible or not. As US furniture traditionally is unfinished on non-visible surfaces the Japanese view this as a poor quality issue (Nomoto, 1994). Wood grain is another measure of furniture quality in Japan. Consumers look for straight grain within pieces and matching grain at joints (Nomoto, 1995).

Distribution and Sales
Household furniture is largely sold through furniture speciality stores. In 1997, 65% of household furniture was sold through this channel. Department stores and large supermarkets were next important with 10.5% and 9.8% of household furniture sales respectively. Other channels were catalogue houses (5.9%), home centres (5.0%), and housing companies and other (3.8%) (Nomoto, 1997).

For a time in the 1990s furniture retailers were attempting to rationalise the distribution function. Imported furniture often passed through importers, agents, wholesalers, and other levels of distribution before getting to the retail level. Rationalisation has been achieved by large buyers such as catalogue houses, DIY, and department stores. However, the speciality stores who make up the larges: retailing segment still rely on multi-stage distribution channels. This allows them to reduce their obligations and risk exposure with regard to transportation, distribution, inventory, and product defects.

In general the price of imported household furniture at the retail level is about three times the export price (de Boer and Kosoy, 1997). This is a useful guideline for exporters looking to position their products in Japan.

7.2.1.2 Office/Institutional Furniture

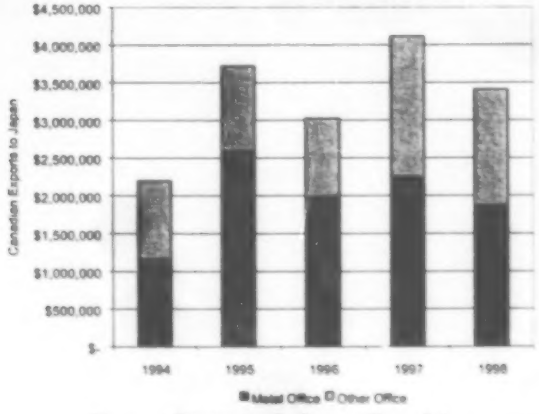
Japanese offices are traditionally very utilitarian with low cost, durable furniture and little or no personal workspace. This has meant limited use of wood in the past. Institutional furniture includes furniture for hotels, restaurants, and public facilities. This furniture is more style and design driven than office furniture and is often made of wood.

Demand factors
The office/institutional furniture market is largely driven by new construction or remodelling of non-residential spaces. Construction and architectural firms are often key decision-makers in the furniture selection for their projects.

Demand for office furnishings (including furniture, lighting, interior finish and air conditioning) is dominated by large companies. Large companies account for 50% of office furnishings demand, medium sized companies 35%, and small companies 15% (Nomoto, 1995)

Canadian Production and Exports
Canada produces only 3% of office furniture in the world, 45% of which was wood based. The US produces 32%, Germany 15%, and Italy and France each account for 7% of world production (Industry Canada, 1998).

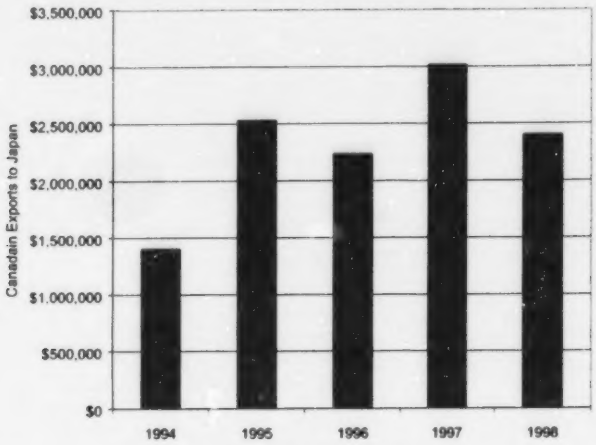
Canada exported close to $3.5 million in office furniture to Japan in 1998 (Figure 38). Exports to this market were surprisingly strong in 1998 considering the general decrease in Japanese imports in 1998.



Source: Strategis (Industry Canada)

Figure 38 Canadian Office Furniture Exports to Japan

Canadian exports of hotel, restaurant and institutional furniture to Japan follows much the same pattern as office furniture (Figure 39). It is generally growing and did not sharply decline with the Asian economic crisis in 1998.



Source: Strategis (Industry Canada)

Figure 39 Canadian Exports of Hotel, Restaurant, and Institutional Furniture to Japan

7.2.2 Material

Material is the second way to classify furniture markets in Japan. Many of the Japanese internal trade statistics are based on material. Materials used are wood, metal, rattan and others such as plastics and composites.

Although statistics based on material do not point to specific end-uses they can be used as general guides. Most household furniture is built from wood. On the other hand, it is estimated that 80-85% of office furniture is made of metal (Namoto, 1995). It is the hotel, restaurant and institutional furniture sector which uses both wood and metal to a high degree.

7.2.3 Order

JETRO breaks up the market for wooden furniture to be ready-made, order-made, and semi-order-made.

Ready-made Furniture

Ready-made furniture is largely household furniture sold through retail channels. Figure 40 displays the retail channels used for furniture in 1994.

Table 28 Sales of Furniture in Retail Channels

Sales by retail channel (1994)	
Channel	Share of Retail Sales (%)
Furniture Stores (total)	**59%**
small	*10.9*
medium	*18.6*
large	*29.5*
Department Stores	**15.4**
General Merchandise Stores	**15.6**
Others	**10.0**

Source: JETRO

Ready-made furniture usually has multi-layered distribution. It is estimated that once furniture reaches the retail floor the sticker price is three times the manufacturers price if imported and two times the manufacturers price if domestic (JETRO).

Order-made Furniture
Order-made furniture is common in the office/institutional segment. This furniture is custom ordered by builders, architects and interior decorators to outfit new or renovated non-residential spaces. The US Department of Commerce estimates that contract furniture could account for 30-40% of Japanese furniture sales. Contracts for order-made furniture are usually open for bidders and are very competitive.

Up to 80% office furniture is distributed directly from the manufacturer to the customer. The remaining 20% is distributed through sales offices, retail channels, and architectural or construction companies (Nomoto, 1996).

Semi-order-made Furniture
The semi-order made furniture segment could be classified a customised, but not custom. Furniture in standard formats is produced but finishes, fabrics, and some other features may be specified by the consumer. This type of furniture is common in the household market. However, the concept can be expanded to the office/institutional market as it has been in North America.

In the household furniture market consumers are willing to wait up to three months for semi-order-made furniture. This timespan could be met by Canadian producers who wished to enter this market.

Furniture ordered in this fashion is seen to have great potential. JETRO reports tremendous growth in this sector in recent years. As markets mature in Japan and move more toward replacement furniture the move to customised is expected to grow as well.

7.3 Production of Furniture

When producing furniture for foreign markets sizes may not be the same as in domestic markets. Factors such as room size, physical characteristics of users, and local traditions may dictate the size of furniture. Table 29 is a compilation of recommended furniture dimensions for the Japanese market.

Table 29 ***Recommended Furniture Sizes for Japan***

Mattress/Bed			
	Width	*Length/Regular*	*Length/Long*
Single	1,010cm	1,950cm	2,100cm
Semi-double	1,210	1,950	2,100
Double	1,410	1,950	2,100
Double-wide	1,530	1,950	2,100
Queen	1,690	1,950	2,100
Sofa			
	Width	*Depth*	*Seat Height*
3 Seat:	2,110	1,000	430
Love Seat:	1,610	1,000	400
Arm Chair:	1,010	1,000	400
Dining Table			
	Width	*Height*	*Length*
Large:	900	640	1800
Medium:	900	640	1600
Small:	900	640	1200
Dining Chair			
	Width	*Depth*	*Seat Height*
Large:	590	590	430
Medium:	500	570	420
Small:	475	540	400
Desk			
	Width	*Height*	*Length*
Large:	1,500	700	730
Medium:	1,200	700	730
Small:	898	600	725
Swivel Chair			
	Width	Depth	Height
Large:	570	630	420
Medium:	560	560	400
Small:	480	590	400
	Width	Depth	Height
Restaurant Chair	430-470	400-430	380-420
Hotel Lounge Chair	500-600	500-530	380-420
Hotel Writing Chair	450-470	380-430	400-420

Source: DFAIT, US Dept. of Commerce

Additionally, furniture pieces should not exceed 1.8 metres high and 0.9 metres wide in order to fit through the standard Japanese doorway (DFAIT, 1998).

Market Access

Furniture for export to Japan has very few official criteria to meet. The law that applies to all furniture imports is the Household Goods Quality Labelling Law. Under this law labelling is required on chairs, stools, desks and chests sold in Japan (JETRO). These labels are much like Canadian furniture labels under the Upholstered and Stuffed Articles Act. Product attributes which must be specified on the label are; dimensions, surface materials, surface processing, structural members, upholstery, and cushioning. The burden of labelling is actually on the importers and distributors of furniture in Japan. However, labelling at the time of manufacture is by default a market entry requirement.

The Product Liability Law stipulates that compensation will be granted for any injuries to life or property which arise due to product defects. This law covers all products shipped or imported into Japan for a ten year period. In the case of imported goods the importer carries the liability.

Any furniture product which involves electrical wiring must meet standards set out in the Electrical Appliance and Materials Control Law. Under this law the importer must notify the Ministry of International Trade and Industry (MITI) that the product will be entering the market and that it meets MITI standards. There is also a voluntary electrical product certification system in Japan through JET. Labelling is an important decision factor for retailers and consumers and is, therefore, advised for all electrical products to be exported to Japan.

Japan Industrial Standards (JIS) also have standards for ordinary beds, bunk beds, and cribs.

Further, there are no tariffs on furniture imports.

7.4 Results: Wood Furniture

7.4.1 Wood Furniture Attributes Demanded in Japan

As BC and other provinces move forward in the value chain, wood furniture represents one of the higher levels of value-added wood products manufacturing. In this study 225 Japanese consumers and 50 designers were surveyed as to their preferences for furniture.

7.4.1.1 Wood Furniture Survey Results

Respondents were asked to rank the importance of a series of furniture attributes. These are reported in Table 30. Price[6] and durability were the most important attributes for both groups. The third most important furniture attribute for consumers was design. The point of sale and the country of manufacture were of least importance to both groups.

[6] Price in this case is positively related to market share. That is, in the market scenarios market share rose with a price rise.

Table 30 Most Important Attributes for Wood Furniture

Attribute	Consumers	Designers
price	1	1
durability – *(how long it will last)*	2	2
design is very fashionable	3	4
colour of finish	4	5
type of finish	5	3
where the furniture is made	6	6
where the furniture is sold	7	7

Designers and consumers were also asked to indicate their degree of preference for different furniture materials. It is clear that wood is the most preferred material for both groups with average preference ratings above 6 out of seven for both groups. Designers gave metal and composites neutral ratings of 4 out of seven. Consumers rated metal, plastics and composites below neutral.

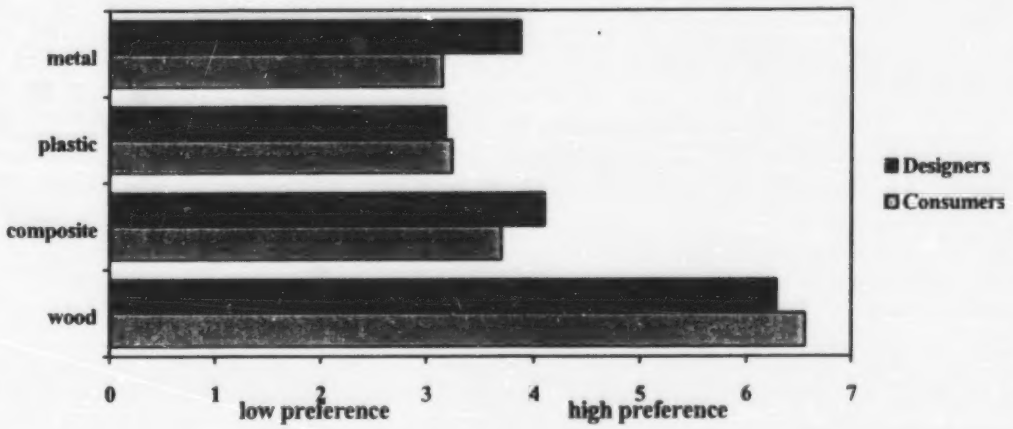


Figure 40 Material Preference for Furniture

Respondents were asked, "How do you expect the popularity of the following designs to change over the next 3 years". Results are shown in Table 31. It is clear that casual living or North American design is expected to grow the most in the coming years. This growth is expected to come at the expense of fine European and traditional Japanese designs. This creates some opportunities for BC Pine furniture manufacturers who are already familiar with North American or casual design.

Table 31 Consumers'/Builder's Expected Furniture Design Changes 1998-2001

Percent of *consumers/builders* indicating this change			
Design style	decrease	stay the same	increase
Fine European	23%/30%	34/42	43/28
Scandinavian	22/6	46/70	31/24
Traditional Japanese	36/40	41/46	23/14
American (casual living)	8/5	29/45	**63/50**

Consumers were also asked why they would replace their furniture. Listed below are the reasons and the percent of respondents that selected that reason.

- Because it is worn out 37%,
- To change style 30%,
- Moving to new house 27%,
- Other 07%.

Although durability was the most important attribute besides price, only one third of furniture is replaced because it is worn out. Thirty percent of consumers said they changed their furniture simply to change styles. An additional 27% indicated that they would change their furniture next because they are moving to a new home. Keep in mind that the time between house changes is about 15 to 25 years. Respondents indicate they expect furniture to be long lasting with the vast majority expecting it to last over ten years. This indicates that there is not a big market for low quality, low price disposable furniture common in some furniture stores in North America.

7.4.1.2 Conjoint Analysis Results

Price
Over half of consumers surveyed are willing to pay an above average price for household furniture. This makes the findings on the other attributes very important since it is of interest to know what furniture characteristics consumers are willing to pay a premium for. For designers there was virtually no difference among the frequency of selection of the four price categories.

Location in House
Almost an equal number of consumers are interested in furniture in each of the four locations: kitchen, living room, bedroom and dining room. Thus BC suppliers can consider furniture for one, a few, or all of these locations. Consumers are less price sensitive than many of the others groups interviewed with large consumer segments willing to pay above average prices for furniture in most rooms of a house. Designers indicate a strong preference for natural finishes in living rooms, bedrooms and dining rooms. For kitchens they preferred a paint finish or a stain with a clear finish.

Finish
Consumers selected a natural finish most frequently but only by a small margin over the other levels of finish identified in the study. Well over half of the designers selected either a natural finish or a stain with a clear finish. Both of these types of finish enable the grain to show through suggesting that type of sawing, which leads to visible grain, is key to targeting the Japanese market for furniture.

Colour
Over half of consumers select a light or very light finish. This indicates potential for the lighter coloured woods from BC such as Pine or Hemlock. It is also interesting to note a large segment (24%) prefers dark colours, which may indicate an opportunity for Douglas fir furniture. The conjoint analysis allowed us to find out what colours are preferred in which locations. Light or very light colours are preferred in the living room (and some dark colours). In the kitchen medium and light colours are selected most frequently. In bedrooms medium and very light colours are the most frequent choice. In the dining room dark and light colours are selected most frequently .

While all colours are selected, lighter colours are preferred by almost 60% of the designers. This reaffirms the apparent trend towards light coloured wood that benefits BC producers because of the preponderance of Pine in the interior and Hemlock on the coast, both light coloured woods. It is interesting to find that designers consider a lighter colour to be associated with more durable furniture. This may be due to the fact that the high quality Scandinavian furniture that has been imported into Japan is predominantly light coloured.

Durability
Durability ranks second only to price in the relative importance of furniture attributes in the questionnaire. Over two thirds of consumers and designers prefer furniture to last 10 years or more. This indicates very little market share for low-quality, low-priced, temporary furniture. If producers wish to access the Japanese market they should only do so with furniture that will have good durability. Consumers expect Scandinavian and fine European design to last the longest followed by American design and lastly Japanese styles. Interestingly, there is a direct relationship between willingness to pay a premium and how long the furniture is expected to last. Any furniture targeted towards an above average selling price in Japan must have a long life.

Design
Fine European and Scandinavian designs are selected the most by consumers. American or casual living design is selected by 22% of respondents, a figure much lower than actual market conditions. For all four locations in the house Scandinavian and Fine European design are the most selected with American ranking third. American or casual living design is selected most frequently for use in kitchens and living rooms by consumers.

Scandinavian furniture is selected most frequently by designers followed by North American casual, fine European design and lastly traditional Japanese design. North American or Scandinavian style is preferred for living rooms and bedrooms. In the kitchen casual design is strongly outranked by Scandinavian design.

7.4.2 Attributes Supplied by British Columbia

In 1995 British Columbia had 55 wooden household furniture manufacturers, with shipments of $107 million (Industry Canada).

Wood Resource
BC/Canada has a diverse forest resource to cater to the colour and wood figure preferences of the Japanese market (wood figure referring to such things as wood grain orientation, rings per inch and so on). These are listed in Table 32.

Table 32 Colour and Figure of Selected B.C. Species

Species	Colour of dry Heartwood	Plainsawn lumber or rotary-cut veneer	Quartersawn Lumber or Quarter-sliced veneer
Red Alder	Pale pinkish brown	Faint growth ring	Scattered large flakes, sometimes entirely absent
Western red Cedar	Reddish brown	Distinct, inconspicuous growth ring	Faint growth ring stripe
Yellow Cedar	Yellow	Faint growth ring	None
Douglas fir	Orange red to red, sometimes yellow	Conspicuous growth ring	Distinct, inconspicuous growth stripe
Balsam Fir	Nearly White	Distinct, inconspicuous growth ring	Faint growth ring stripe
Western Hemlock	Light reddish brown	Distinct, inconspicuous growth ring	Faint growth ring stripe
Western Larch	Russet to reddish brown	Conspicuous growth ring	Distinct, inconspicuous growth stripe
Lodgepole pine	Light reddish brown	Distinct, inconspicuous growth ring; faint pocked appearance	None
Western white pine	Cream to light reddish brown	Faint growth ring	None
Ponderosa Pine	Orange to reddish brown	Distinct, inconspicuous growth ring	Faint growth ring
Spruce: black, Engelman, and White	Nearly white	Faint growth ring	None
Sitka Spruce	Light reddish brown	Distinct, inconspicuous growth ring	Faint growth ring stripe

Source: Wood Handbook

Table 33 Machining Properties for 15 B.C. Wood Species

Species	Specific Gravity	Turning		Planing		Sanding	Boring		Mortising		Shaping
		Good to excellent		Defect-free		Defect-free	Good to excellent		Fair to excellent		Good to excellent
		Single-point	Rotary-knife	Ave.	Best		Single Twist	Brad Point	Chain	Hollow Chisel	
SOFTWOODS		%	%	%	%	%	%	%	%	%	%
Amabilis Fir	0.43	4	71	38	76	92	16	58	56	96	90
Douglas-fir	0.51	78	94	70	100	98	75	96	100	100	98
Lodgepole Pine	0.46	18	66	97	100	98	19	44	83	97	86
Sitka Spruce	0.42	6	35	55	84	100	20	68	96	88	84
Subalpine Fir	0.37	26	34	64	86	98	26	72	84	80	80
Western Hemlock	0.50	12	47	54	78	96	48	86	89	100	76
Western Larch	0.60	36	98	76	92	100	64	92	60	80	82
Western Red Cedar	0.34	30	34	69	84	100	38	82	56	76	84
Western White Pine	0.43	8	96	88	96	96	57	65	72	96	100
Western White Spruce	0.40	2	48	80	96	96	24	56	88	83	74
Yellow Cedar	0.47	18	92	96	98	100	31	65	52	100	98
HARDWOODS											
Black Cottonwood	0.39	2	30	47	72	80	10	29	48	73	33
Red Alder	0.49	52	85	90	96	100	25	67	64	100	94
Trembling Aspen	0.47	2	50	80	100	96	55	73	44	96	98
Western White Birch	0.61	37	100	98	100	98	92	92	64	100	96

Reprinted from FCC SP-39

One wood property which is important in value-added products such as furniture is hardness. Table 34 displays the specific gravity and side and end hardnesses of some common BC species. For furniture manufacturing the side hardness is most important. Again, western white birch is a standout in this category. Technologies for hardening wood are new to the market and still undergoing rapid development. These technologies could expand the list of appropriate BC species for furniture production.

Table 34 Specific Gravity and Hardness of BC Species

Species	Specific Gravity	Hardness (N)[f g]	
		Side	End
SOFTWOODS			
Amabilis Fir	.39	1970	3710
Douglas-fir	.49	2990	4020
Lodgepole Pine	.41	2190	2990
Sitka Spruce	.39	2200	3090
Subalpine Fir	N/A	N/A	N/A
Western Hemlock	.43	2740	4410
Western Larch	.58	4210	5670
Western Red Cedar	.34	1470	3000
Western White Pine	.37	1700	2280
Western White Spruce	.37	1880	2470
Yellow Cedar			
Yellow Cypress	.43	2510	3960
Ponderosa Pine	.46	2640	3360
Engelmann Spruce	.39	2020	2660
HARDWOODS			
Black Cottonwood	.33	1350	2000
Red Alder	0.49	2490	4360
Trembling Aspen	.42	2140	2820
Western White Birch	.6	4110	4640
Broadleaf Maple	.53	4110	5780

Source: FCC SP 514E

Aspen is the deciduous species most common to BC (Table 35). Commercialisation of aspen as a furniture species would likely require it to be hardened in some way. The next most plentiful species is cottonwood, which has even less hardness. White birch is the third most plentiful deciduous species in BC (interior), and has attractive hardness for furniture production. Red alder (BC coast) is also in plentiful supply and possesses good properties for furniture production.

[f] Load required to imbed 11.3 mm sphere to half diameter.

[g] Air dry condition

Canadian softwoods also provide a wide variety of colours from light to dark for wood furniture. To be competitive in this market they would likely need some type of hardening to increase their durability.

Table 35 BC Mature Standing Deciduous Timber Volume

(million cubic metres)- as at Dec 31, 1996[b]

Species	Coast	Interior	Total Province
Aspen	<0.5	242	242
Cottonwood	5	52	57
White Birch	1	25	26
Alder	4	<0.5	4
Maple	2	-	2
Misc.	2	7	9
Total Hardwoods	*14*	*326*	*340*

Source: COFI

White birch may be one of the key species to focus in one for the production of wood furniture. It has excellent machining properties, is very hard, and has a light colour which is preferred in the market.

7.5 Linking Supply with Demand: Product Opportunities

Five opportunities were identified for BC/Canada wood furniture:

1. North American Casual Household Furniture;
2. Systems Furniture for Pre-fabricated Homes;
3. Contract Furniture;
4. Office Furniture;
5. Home Office Furniture.

7.5.1 North American Casual Household Furniture

Given the relative importance of both durability and design in the questionnaire results a product with casual living design, yet 'built to last like fine European furniture', provides market opportunities in Japan.

Canadian furniture manufacturers are familiar with this style and already have existing design and production expertise in this area. However, modifications to existing furniture to Japanese sizes will be needed. In addition, attention must be given to finish and durability. The results of the attribute study above indicate the colour, style and finish preferences for each room.

It seems that the market is willing to support a medium to high priced items if they are deemed to be of high durability. Household furniture has the most levels of distribution and thus the highest mark-ups from export prices. If producers can find more efficient channels to the market they may be able to do one of two things. First, they may be able to reduce the final price of their goods in the market. Second, producers may be able to support a higher export price by moving more directly to market. This would

[b] 1998 COFI Factbook

allow for higher margins, or the production of higher quality furniture at a given price level. Wood hardening one such value-adding process which would increase quality.

7.5.2 Systems Furniture for Pre-fabricated Homes.

As Japanese houses are smaller than North American houses storage space is often at a premium. With limited floor space furniture items such as chests of drawers and wardrobes are cumbersome. The Japanese solution to storage is built in or custom fit 'systems furniture'. These are wall units that contain shelves, drawers, and sometimes closet space.

Systems furniture emphasises function first and style second. For this reason many Japanese furniture manufacturers are not interested in producing it (looking at system furniture as a low-end item). This would represent an opportunity for exporters if it were not for the custom fit requirements of the segment. However, as Japanese homes are now being pre-fabricated in Canada for containerised export to Japan there exists the opportunity for furniture manufacturers to build system furniture to add value to the prefabricated package.

7.5.3 Contract Furniture

Canada exports very little contract (non-retail) furniture to Japan. However, this segment represents an opportunity for Canadian producer. The primary reason for this is that western style furniture is becoming popular in Japan, both in homes and in non-residential buildings (including offices and restaurants).

To enter this market a company must establish a presence in the architectural and design communities in Japan. As a furniture manufacturer it may be advisable to ally with producers of other complementary interior finish items such as wall and floor coverings and lighting fixtures in order to provide a complete package.

7.5.4 Semi-Order Furniture

Semi-order furniture is an opportunity for Canadian furniture producers who have the capability to adhere to strict production timelines. This is custom finished furniture on a standardised platform. Finishes, upholstery or other features can be customized by order.

Semi-order furniture would require that Canadian manufacturers be represented by Japanese furniture stores that display and take orders for the furniture. Such an arrangement cuts down on the level of distribution and thus cuts costs.

7.5.5 Office Furniture

Although the office furniture segment traditionally buys metal furniture this segment may be worth considering. There is talk of an emerging trend towards more western style offices designed for worker comfort. While overall Canadian furniture exports to Japan are quite small, a large portion of the actual trade is in wood office furniture. Perhaps there is a strength in this area we can expand upon.

7.5.6 Home Office Furniture.

As lifetime employment in Japan becomes less common there are an increasing number of well-educated and experienced Japanese who are working as independent consultants or contractors out of their homes. This is creating a market for a new category called SOHO (small office / home office) furniture.

As Japanese houses are quite restricted on space SOHO furniture is likely to be placed in common areas of the home. For this reason the utilitarian style of metal furniture is both unattractive and space consuming. The challenge to potential producers of SOHO furniture is to create attractive office furniture which is convertible into regular living furniture.

SOHO furniture requires all of the quality and style elements of consumer furniture as well as the functionality of office furniture. Light coloured wood with a North American casual style may be an appropriate Canadian entry to this market. Durability is likely to be an even greater issue as SOHO furniture will be subject to extensive use.

8 Interior Finish

Major trends and opportunities in interior finish include:

- As with furniture, a strong trend to light colours, creating opportunities for Canadian softwoods
  - Largest demand for floors, followed by stair parts and doors, wainscot and windows
  - Wood floor demand strengthening in Japan with "healthy house"; however, solid wood flooring still have a small market share in Japan.

8.1 Attributes Demanded in Japan

Three groups were surveyed as to their preferences in interior finish in Japan. These were consumers, designers and builders. Interior finish includes a wide variety of products such as cabinets, flooring, stairs, moulding, trim, wainscoting, and ceilings. While wood has been losing market share over the past decade there is still a very large market for wood interior finish due to the large number of housing starts.

8.1.1 Survey Question Results

Durability was the highest ranked attribute for interior finish among the three groups surveyed (Table 36). This is a logical outcome as there is virtually no repair and renovation activities to speak of in Japan. Therefore, it is very important that interior finish lasts the life of a house. The type of material used is very important to consumers and designers, but less so for builders. Healthy house issues are also quite important. On the other hand, source of supply is of least importance to all groups.

Table 36 Most Important Attributes for Interior Finish

Attribute	Consumers	Designers	Builders
Durability – *(how long they will last)*	1	2	1
Material - *(metal, wood, plastic)*	2	1	4
Health - *(emissions of harmful gasses)*	3	5	2
Colour	4	6	7
Location of wood feature - *(moulding, flooring etc.)*	5	3	3
Maintenance required	6	7	5
Species of wood	7	4	6
Source of supply	8	9	8
Style	-	8	-

It is clear that wood is the most preferred material for interior finish (Figure 41). Solid wood was by far the material of choice for all three groups. Wood veneer composites, laminates and other wood/non-wood combinations finish a distant second to solid wood. In general metals and plastics were the lowest ranked materials. It is interesting to note that designers ranked metal much higher than the other groups.

Note: Both Table 36 and Figure 41 report ranking preferences independent on one-another and price. This explains why, for example, solid wood flooring is not common in Japan, as specifiers trade off the choice of solid wood with price and possibly durability.

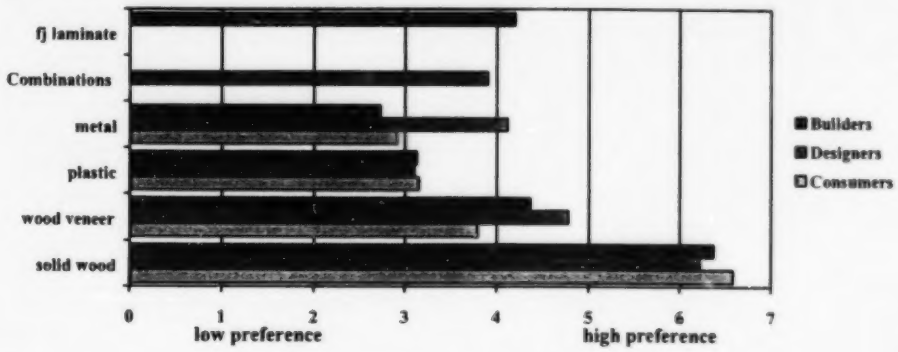


Figure 41 Material Preference for Interior Finish

The three most important locations for wood interior finish were flooring, stairways, and doors (Table 37). Of these three, floors were ranked well above the rest. Designers were further asked how they expected the market for wood interior finish to change in the coming five years. They expect the market for flooring to grow the most in this period (Table 38).

Table 37 Most Preferable Location for Wood Interior Finish Items

Location	Consumers	Designers	Builders
Flooring	1	1	1
Stairways	2	2	2
Doors	3	3	3
Stair railings	4	5	6
Wainscot	5	4	4
Cabinet doors	6	8	8
Moulding	7	6	7
Windows	8	7	5
Kitchen cabinets	9	9	9
Bathroom cabinets	10	9	10

Table 38 Designers' Expected Change in Wood Interior Finish Items

Product	% Change in five years
flooring	14.6
stairways	6.0
doors	8.5
wainscoting	0.8
stair railings	4.5
moulding	-2.3
windows	1.1
cabinet doors	0.3
kitchen and bathroom cabinets	-3.7

8.1.2 Conjoint Results: Interior Finish

Price

There are sizeable market segments for both for low priced interior finish and higher priced interior finish items. Over 40% of consumers indicated a willingness to pay at least a 10% premium compared to current prices. Further, 45% of designers were willing to pay a 20% premium depending on the attributes supplied. Price is of greater concern to builders with few indicating any willingness to pay above current market prices.

Colour

There is near unanimity among consumers, designers and builders that light or very light colours are preferred since they are selected most frequently but with sizeable niches willing to accept medium and dark colours. This strong preference for light colours should continue as the Japanese adjust to a living space that is no longer based on use from the floor level (i.e. sitting on the floor) but from a typical western furniture height. Lighter colours expand the perception of space. Of interest is the fact that almost a quarter of consumers choose dark coloured materials. Respondents are not willing to pay any premium for dark woods. In fact, darkwoods often require a discount for designers. All groups were willing to pay a premium for the lighter colours. However, it appears that a 10% premium is much more likely than a 20% premium. It is interesting to note that light colours receive a higher premium from designers than very light colours.

Location

Again there is near unanimity between all 3 groups that the floor is the most preferred location for wood use indicating a strong potential for continued or increased sales of wood flooring. If consumers were willing to pay above average prices for interior finish items it would be for flooring and to a lesser degree, for walls. All groups are willing to pay a premium for wood used in floors, followed by walls. In walls, light and very light colours are selected much more frequently than medium or dark colours. In floors all colours are selected frequently with dark colours slightly below the rest and very light colours slightly above the rest.

Durability
Japanese consumers and designers select long lasting products with a majority selecting interior finish items which would last as long as the average house life in Japan (20 years plus). Any products targeted towards this market should be designed, manufactured and finished to require minimum maintenance and with at least a twenty-year life span. The concept of replacement every decade or so during renovation is NOT a concept with much acceptance in Japan.

Builders considered durability to be among the most important attributes, however, there is no significant difference between the four levels of durability.

Finish and Health
While a natural finish with no chemicals is preferred, there is a general acceptance of chemical use for interior finish items. A sizeable segment of consumers (43.4%) selected natural finish, an attribute that could distinguish BC interior finish products from others currently in the market. This is a key finding since few of the existing interior finish items available in Japan stress this attribute. It would be worthwhile to explore this niche for products finished with oil, wax or other "natural" finishes. A small but sizeable number of builders are willing to pay 20% premium for natural finishes. Builders select a chemical finish most frequently for floors and a natural finish most frequently for ceilings.

Material
The results for material preference were diverse. Solid softwood is selected almost as frequently as solid hardwood by consumers. Builders prefer solid hardwood, followed by fibreboard core and solid softwood. Designers prefer a fibreboard core with a veneer overlay to solid woods. It is also surprising that they select solid softwood over solid hardwood. Currently hardwoods are used more frequently for interior finish than softwood indicating an opportunity for additional solid softwood items.

There is more willingness to pay premiums for solid wood products. It is interesting that there is almost *equal willingness to pay premiums for solid softwoods and hardwoods.* Solid softwood interior finish was the most favoured at both a 10% discount and a 10% and 20% premium. However, at current prices, solid hardwood is the most preferred material. It is very interesting that builders are willing to pay a 10% premium for solid softwood more frequently than for fibreboard core with veneer (2^{nd}), fibreboard core with non-wood laminate (3^{rd}) and lastly solid hardwoods. If prices increase for all materials equally then solid softwood would gain market share.

8.2 Attributes Supplied by BC/Canada

The BC resource is quite diverse in wood appearance qualities needed for interior finish. Table 32 contains a description of the colour and figure of some BC wood species. Further, Table 33 provides the results of an assessment of the machining quality of selected BC wood species. Table 34 provides the specific gravity and hardness values for BC species. Hardness is an important durability attribute for interior finish items such as floors.

8.3 Product Opportunities

Four interior finish opportunities were identified:

1. Wood flooring;
2. Stair parts;
3. Wood doors;
4. Wood windows.

8.3.1 Wood Flooring

Midway through this project it became apparent that the wood flooring market in Japan was a prime opportunity warranting further research. With funding from Forest Renewal BC, the University of British Columbia and Forintek Canada Corp. undertook a sub-project specific to this market opportunity. The final report "The Japanese Market for Wood Flooring and Wood Windows" (Wahl, A., D. Cohen, R. Kozak and C. Gaston, 1999) is available through Forintek in Vancouver.

Currently, 95% of the wood flooring market is composites produced primarily in Southeast Asia. The 5% of solid wood floor is growing with the increased construction of 2 by 4 houses in Japan.

The study found that the best opportunities were for light, colour matched floors with a polyurethane finish. Whereas existing solid wood floors are very expensive, a moderately priced solid softwood floor may be promising, given it is treated with a hardener.

From the review of the BC resource it is clear that the province is well endowed with softwood species. Of the BC hardwood species, most are of lower density and hardness than the typical hardwood used in flooring. Given that a process can be developed to harden wood with little chemical use, BC/Canada is well positioned to offer Japan a wide variety of species, colours and grain variations.

8.3.2 Wood Stairways

Wood stairways were the second most important application for wood interior finish in this study. Stair components are high value-added products that can be produced in Canada with Canadian species. As with flooring, durability is very important for this application. For this reason attention should be paid to finishing surfaces for durability.

8.3.3 Doors

There is high interest in wood doors in Japan. Due to fire regulations exterior wood doors are very restricted. However, interior wood doors have good potential in Japanese houses. Further, 2x4 starts in Japan are more likely to specify wood doors, both interior and exterior where allowed by fire code.

8.3.4 Windows

The opportunity for wood windows was explored by Wall et al. While there is some interest in wood windows their use is restricted by fire regulations in much of urban and suburban Japan.

9 Outdoor Furnishings and Decking

There is a strong trend in Japan to incorporate "outdoor living" into their lifestyles, something that has not existed in the past.

- Excellent opportunity for BC western red cedar, both in lumber sales to Japan and in the exporting of systems and matching components (including decking, fencing, and outdoor furniture).

9.1 Attributes Demanded in Japan

As larger houses and three story houses grow in popularity so does the desire to complete some landscaping on the small yards typical of Japanese homes. This includes using various types of outdoor furnishings such as decking, fencing, latticework, outdoor furniture, etc.

9.1.1 Outdoor Furnishings and Decking Survey Results

Consumers were the only specifier group surveyed in this portion of the study. It is clear that durability, price and material are the most important attributes. This indicates potential for Western Red Cedar products since they are very durable and they are competitively priced relative to other naturally durable solid woods such as teak and redwood.

Table 39 Most Important Attributes for Outdoor Furnishings

Attribute	Score
durability	1
price	2
material	3
maintenance	4
finish	5
colour	6

Further information was collected concerning preferences for various materials (Figure 42). It is clear that there is a negative attitude towards CCA treated wood for use in outdoor furnishings. There is little difference between most of the other materials indicating both opportunities and threats for BC wood products for outdoor furnishings. On further examination of material preference it would appear that clear preferences have not yet been formed by consumers in this new product group. The general low scores, combined with little differentiation among materials, usually indicate that there is confusion among consumers in this market. Given the recent interest in outdoor furnishings the Japanese consumer has yet to establish strong material preferences which creates some opportunities and threats for products made from Western Red Cedar. The high score for the "other" category also supports this contention.

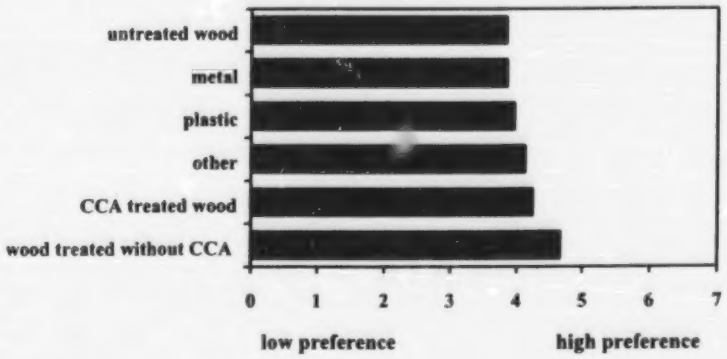


Figure 42 Material Preference for Outdoor Furnishings

9.1.2 Conjoint Analysis Results

Price
Consumers are very price sensitive when it came to outdoor furnishings. However there is a significant niche willing to pay 10-20% more depending on the other attibutes. Price was the second most important product attribute in the questionnaire.

Maintenance
These results indicate a strong desire among consumers to minimize maintenance requirements for outdoor furnishings. This is logical given the lack of skills in the Japanese consumer for "handyman" projects. Almost two thirds of the consumers interviewed are willing to pay a 10-20% price premium for products that require no maintenance for ten years.

Type of Wood
Japanese Sugi is the most preferred species. However of all the imported species, including treated wood, Canadian Red Cedar ranks highest indicating opportunities for BC producers, as material is such an important product attribute for consumers. Sugi is the least price sensitive followed by Cedar, Redwood and CCA treated wood. However if Cedar and Sugi were priced the same consumers would chose Sugi most of the time.

Colour
Given the general Japanese preference for light wood among most other wood products examined, it is surprising to find that dark or medium woods are preferred over lighter coloured wood for outdoor furnishings. This indicates a potential for increased exports of BC finished outdoor Cedar products especially if dark coloured Cedar is sorted specifically for the Japanese market.

Durability
As expected respondents prefer more durable outdoor furnishings and decking. However when durability is compared with maintenance preferences, it seems that Japanese consumers would like to purchase outdoor furnishings and decking that require no maintenance but instead are replaced when refinishing is

required. Durability ranks as the most important product attribute in the questionnaire, even of more importance than price. Results indicate that despite the price sensitivity of consumers, they expect outdoor furnishings to last longer if they pay a premium. However it must be stressed that consumers are very price sensitive in this product category. The importance of durability (first) among attributes combined with the desire to minimise maintenance indicates the need to produce no-maintenance, long lasting outdoor furnishings

Product Bundling
There is an even distribution between all four choices in this product attribute. Three of the four choices include some form of product bundling. That is to say, while there may be a good market for Cedar decking, if it is bundled with other outdoor furnishings the market size could grow substantially.

9.2 Attributes Supplied by BC

British Columbia is home of several naturally durable softwood species. Western red cedar heartwood and yellow cedar heartwood are very resistant to decay and insect attack. These two species are very appropriate for outdoor use. The heartwood of Douglas-fir and western larch and moderately resistant and can be used outdoor with some precaution.

Hem-fir, one of British Columbia's more abundant species groups, has been very popular in Japan as a treated wood product, although more for sill plates in the post and beam house structure than for outdoor projects.

Table 40 describes the colour and figure of some of the species which may be used in outdoor decking and furniture. The variety of species may serve as a competitive advantage for British Colombian producers.

Table 40 Colour and Figure of Durable B.C. Species

Species	Colour of dry Heartwood	Type of Figure	
		Plainsawn lumber or rotary-cut veneer	Quartersawn Lumber or Quarter-sliced veneer
Western red Cedar	Reddish brown	Distinct, inconspicuous growth ring	Faint growth ring stripe
Yellow Cedar	Yellow	Faint growth ring	None
Douglas fir	Orange red to red, sometimes yellow	Conspicuous growth ring	Distinct, inconspicuous growth stripe
Western Hemlock	Light reddish brown	Distinct, inconspicuous growth ring	Faint growth ring stripe
Western Larch	Russet to reddish brown	Conspicuous growth ring	Distinct, inconspicuous growth stripe

Source: Wood Handbook

The machining properties for durable BC woods appear in Table 41. The most likely species to be used for decking and outdoor furniture, western red cedar, has perhaps the lowest machining properties. While western red cedar planes and sands well it performed poorly in other tests. This may reduce the use of western red cedar to simpler, more rustic designs and finishes.

Table 41 Machining Properties for Durable B.C. Woods

Species	Specific Gravity	Turning		Planing		Sanding	Boring		Mortising		Shaping
		Good to excellent		Defect-free		Defect-free	Good to excellent		Fair to excellent		Good to excellent
		Single -point	Rotary-knife	Ave.	Best		Single Twist	Brad Point	Chain	Hollow Chisel	
SOFTWOODS		%	%	%	%	%	%	%	%	%	%
Douglas-fir	0.51	78	94	70	100	98	75	96	100	100	98
Western Hemlock (treated)	0.50	12	47	54	78	96	48	86	89	100	76
Western Larch	0.60	36	98	76	92	100	64	92	60	80	82
Western Red Cedar	0.34	30	34	69	84	100	38	82	56	76	84
Yellow Cedar	0.47	18	92	96	98	100	31	65	52	100	98

Reprinted from FCC SP-39

The low specific gravity and hardness of western red cedar reinforces the assertion that outdoor decking and furniture of the species should be designed to be finished in a simple fashion that will not highlight nicks and dents in the wood.

Table 42 Specific Gravity and Hardness of BC Species

Species	Specific Gravity	Hardness (N)[1]	
		Side	End
SOFTWOODS			
Douglas-fir	.49	2990	4020
Western Hemlock	.43	2740	4410
Western Larch	.58	4210	5670
Western Red Cedar	.34	1470	3000

Source: FCC SP 514E

Given the value-added nature of outdoor furniture and decking for the Japanese market BC has an ample supply of the species of greatest interest, western red cedar and yellow cedar.

[1] Load required to imbed 11.3 mm sphere to half diameter.

[2] Air dry condition

Table 43 BC Mature Standing Coniferous Timber Volume

(million cubic metres)- as at Dec 31, 1996

Species	Coast	Interior	Total Province
Hemlock	1183	294	1477
Douglas Fir	133	287	420
Red Cedar	289	96	385
Yellow Cedar	109	<0.5	109
Red/Yellow Cedar	261	15	276
Larch	-	28	28
Total Softwoods	*2532*	*4537*	*7069*

Source: COFI

9.3 Linking Supply with Demand: Product Opportunities

9.3.1 Cedar Outdoor Living System

A western red cedar system of products for outdoor living is a market opportunity in Japan. The use of cedar fits well with the preferences in the market. Cedar is a dark colour and is has a high degree of natural durability. The challenge for this market is to assemble and market products appropriate for Japanese consumers.

It is important to understand that the handy-man culture is new to Japan, if it exists at all. The Japanese are not accustomed to doing maintenance work around the home. This is an important consideration for a line of outdoor living products. These products must be virtually maintenance free, as consumers indicated in the study that they would pay a premium for products to be free of maintenance for ten years.

In addition to maintenance there is the issue of assembly. It is common in North America to purchase outdoor living products at garden stores or home improvement centres in the ready-to-assemble (RTA) form. Though the home centre channel does exist in Japan it is not nearly as developed as in North America. Further, this may not be appropriate product format and distribution for the Japanese market. As previously mentioned, it is not common for Japanese to work with tools around the home, casting doubt on the RTA format. Therefore, a different distribution channel which could provide finished products may be more appropriate.

The following cedar products could be considered for the Japanese market.

1. Furniture
2. Fencing
3. Decking
4. Shed
5. Gazebo
6. Planters
7. Lattice-work
8. Arbors
9. Walkways

10 References

Anon. 1996. Japanese Agricultural Standard for Structural Glued Laminated Timber. Ministry of Agriculture, Forestry and Fisheries (Japan).

Anon. 1997. National Design Specification for Wood Construction. American Forest and Paper Association.

Anon. 1997. Japan's Residential Construction Market. US Department of Commerce.

Anon. 1998. British Columbia Forest Industry Fact Book -1998. Council of Forest Industries.

Anon. 1998. Japan's DIY/Home Center Industry. US Department of Commerce.

Anon. 1999. Housing Market Intelligence Study of Japan. CMHC- Canadian Housing Export Centre. (Draft)

Anon. 1999. Major Primary Timber Processing Facilities in British Columbia 1998. British Columbia Ministry of Forests.

Anon. Hotel, Restaurant and Institutional Furniture and Fixtures Industry. Industry Canada. Strategis

Anon. Market Opportunities in Japan for Furniture 1999. 1998. Department of Foreign Affairs and International Trade.

Anon. The Office Furniture Market in Japan. March 1997. Team Canada Market Research Centre. Department of Foreign Affairs, Ottawa.

Anon. Wooden Household Furniture Industry. Industry Canada. Strategis

Anon. 1996. The Hokkaido Market for Housing and Manufactured Building Products. Canadian Department of Foreign and International Trade.

Anon. 1996. Market for Housing and Building Products in the Tokai Region of Japan. Canadian Department of Foreign and International Trade.

Anon. 1998. Review and Outlook- Housing and Lumber Market. Canadian Department of Foreign and International Trade.

Anon. 1998. Trends in Building Products and Housing in Japan. Canadian Department of Foreign and International Trade.

Anon. 1999. The residential Building Materials and Technology Market in Japan. Canadian Department of Foreign and International Trade.

Bazley, Ian. 1997. "RORO" Modular Home Shipping System. CMHC.

Bean, Casey E. and Masaoki Nagahama, 1998. Wood-Framed, 3-Story Residential Construction. USDA Foreign Agricultural Service.

Bean, Casey E. and Masaoki Nagahama, 1999. Housing Market in Transition- GOJ Programs Aimed to Stimulate Demand. USDA Foreign Agricultural Service. GAIN Report # JA9029

Bean, Casey E., 1998. Forest Products Imports Diving- A Mid-Year Review. USDA Foreign Agricultural Service. GAIN Report # JA8095

Bean, Casey E., 1998. Japan's Current Plywood Imports and Softwood Plywood Production. USDA Foreign Agricultural Service. GAIN Report # JA8078

Bean, Casey E., 1998. Pre-cut Lumber- A Wave of the Future in Japan's Post and Beam Home Construction Market. USDA Foreign Agricultural Service. GAIN Report # JA8112

Bean, Casey E., 1998. Japan Forest Products Annual Report 1998. USDA Foreign Agricultural Service. GAIN Report # JA8064

Bean, Casey E., 1999. Japan Forest Products Annual Report 1999. USDA Foreign Agricultural Service. GAIN Report # JA9108

de Boer, John and Robert Kosoy. A Furniture Study of the Tokai Region. March 1997. Canadian Consulate in Nagoya, Japan.

Jessome, A.P. 1986. Strength and Related Properties of Woods Grown in Canada. Forintek Canada Corp. SP 514E

Nagahama, Masaoki and Casey E. Bean. 1998. 1998 White Paper on Japanese Forestry. USDA Foreign Agricultural Service.

Nagahama, Masaoki and Casey E. Bean. 1998. Europe- a New Source of Japan's Lumber Needs. USDA Foreign Agricultural Service.

Nagahama, Masaoki and Casey E. Bean. 1998. 1998 Outlook for Japan's Wood Imports. USDA Foreign Agricultural Service.

Ni, C, D. Fell, and A. Andersen. 1999. Development of Termite-Resistant Glued-Laminated Timber (Progress Report). Forintek Canada Corp.

Nomoto, K. Industry Sector Analysis- Household Furniture. December 1994. US Department of Commerce.

Nomoto, K. International Market Insights- Furniture Market Trends. January 1996. US Department of Commerce.

Nomoto, K. Japan- Office and Institutional Furniture - ISA 9303. March 1995. US Department of Commerce.

Nomoto, K. Japan- Wooden Furniture - ISA 9312. March 1995. US Department of Commerce.

Nomoto, K. SOHO Furniture - ISA 9903. March 1999. US Department of Commerce.

Takabatake, Kazuhisa. 1997. Building Products for Single-Family. US Foreign Commercial Service.

Takabatake, Kazuhisa. 1998. Multi-Family Wooden Houses. US Foreign Commercial Service.

Takabatake, Kazuhisa. 1999. Home Remodelling Market. US Foreign Commercial Service.

Takabatake, Kazuhisa. 1999. Housing Starts in Japan. US Foreign Commercial Service.

Takabatake, Kazuhisa. 1999. Tax Incentives for Home Buyers and Tariff Reductions. US Foreign Commercial Service.

Willians, Derek and Roman Morris. 1998. Machining and Related Mechanical Properties of 15 BC Wood Species. Forintek Canada Corp. SP-39

Appendix
Wood Properties

Table 44 Mechanical Properties[k] of B.C. Softwood Species

	Moisture Content	Specific Gravity	Static bending		Compression Parallel to Grain (psi)	Compression Perpendicular to Grain (psi)	Shear Parallel to Grain (psi)
			Modulus of Rupture (psi)	Modulus of Elasticity (x10^6 psi)			
White spruce	Green	0.35	5,100	1.24	2,470	2400	670
	12%		9,100	1.45	5,360	500	980
Black spruce	Green	0.41	5,900	1.32	2,760	300	800
	12%		11,400	1.52	6,040	620	1,250
Engleman spruce	Green	0.38	5,700	1.25	2,810	270	700
	12%		10,100	1.55	6,150	540	1,100
Sitka spruce	Green	0.35	5,400	1.37	2,560	290	630
	12%		10,100	1.63	5,480	590	980
Western hemlock	Green	0.41	7,000	1.48	3,580	370	750
	12%		11,800	1.79	6,770	660	940
Subalpine fir	Green	0.33	5,200	1.26	2,500	260	680
	12%		8,200	1.48	5,280	540	980
Balsam fir	Green	0.34	5,300	1.13	2,440	240	680
	12%		8,500	1.40	4,980	460	910
Amabilis fir	Green	0.36	5,500	1.35	2,770	230	710
	12%		10,000	1.64	5,930	520	1,190
Douglas-fir	Green	0.45	7,500	1.61	3,610	460	920
	12%		12,800	1.97	7,260	870	1,380
Western Red cedar	Green	0.31	5,300	1.05	2,780	280	700
	12%		7,800	1.19	4,290	500	810
Yellow cedar	Green	0.42	6,600	1.34	3,240	350	880
	12%		11,600	1.59	6,640	690	1,340
Western larch	Green	0.55	8,700	1.65	4,420	520	920
	12%		15,500	2.08	8,840	1,060	1,340
Ponderosa pine	Green	0.44	5,700	1.13	2,840	350	720
	12%		10,600	1.38	6,130	760	1,020
Western white pine	Green	0.36	4,800	1.19	2,520	240	650
	12%		9,300	1.46	5,240	470	920
Lodgepole pine	Green	0.4	5,600	1.27	2,860	280	720
	12%		11,000	1.58	6,260	530	1,240

Source: Wood Handbook

[k] Results from small clear specimens.

Table 45 NLGA Design Values for Visually Graded Dimension Lumber

Species and Commercial Grade	Size Classification	Bending (psi)	Tension Parallel to Grain (psi)	Shear Parallel to Grain (psi)	Compression Perpendicular to Grain (psi)	Compression Parallel to Grain (psi)	Modulus of Elasticity ($x10^6$ psi)
Douglas fir-Larch							
Select Structural	2"-4" thick 2" & wider	1350	825	95	625	1900	1.9
No.1/No.2		850	500	95	625	1400	1.6
No.3		475	300	95	625	825	1.4
Hem-Fir							
Select Structural	2"-4" thick 2" & wider	1300	775	75	370	1700	1.7
No.1/No.2		1000	575	75	370	1450	1.6
No.3		575	325	75	370	850	1.4
Northern Species							
Select Structural	2"-4" thick 2" & wider	1000	450	65	350	1100	1.1
No.1/No.2		600	275	65	350	850	1.1
No.3		350	150	65	350	500	1.0
Spruce-Pine-Fir							
Select Structural	2"-4" thick 2" & wider	1250	700	70	425	1400	1.5
No.1/No.2		875	450	70	425	1150	1.4
No.3		500	250	70	425	650	1.2

Table 46 NLGA Design Values for Visually Graded Timbers

Species and Commercial Grade	Size Classification	Bending (psi)	Tension Parallel to Grain (psi)	Shear Parallel to Grain (psi)	Compression Perpendicular to Grain (psi)	Compression Parallel to Grain (psi)	Modulus of Elasticity ($x10^6$ psi)
Coast Sitka Spruce							
Select Structural		1150	675	60	455	775	1.5
No.1	Beams and Stringers	950	475	60	455	650	1.5
No.2		625	325	60	455	425	1.2
Select Structural		1100	725	60	455	825	1.5
No.1	Posts and Timbers	875	575	60	455	725	1.5
No.2		525	350	60	455	500	1.2
Douglas fir-Larch							
Select Structural		1600	950	85	625	1100	1.6
No.1	Beams and Stringers	1300	675	85	625	925	1.6
No.2		875	425	85	625	600	1.3
Select Structural		1500	1000	85	625	1150	1.6
No.1	Posts and Timbers	1200	825	85	625	1000	1.6
No.2		725	475	85	625	700	1.3
Hem-Fir							
Select Structural		1250	725	70	370	900	1.3
No.1	Beams and Stringers	1000	500	70	370	750	1.3
No.2		675	325	70	370	425	1.1
Select Structural		1150	775	70	370	950	1.3
No.1	Posts and Timbers	925	625	70	370	850	1.3
No.2		550	375	70	370	575	1.1
Western Hemlock							
Select Structural		1400	825	70	410	1000	1.4
No.1	Beams and Stringers	1150	575	70	410	850	1.4
No.2		750	375	70	410	550	1.1
Select Structural		1300	875	70	410	1100	1.4
No.1	Posts and Timbers	1050	700	70	410	950	1.4
No.2		650	425	70	410	650	1.1
Spruce-Pine-Fir							
Select Structural		1100	650	65	425	775	1.3
No.1	Beams and Stringers	900	450	65	425	625	1.3
No.2		600	300	65	425	425	1.0
Select Structural		1050	700	65	425	800	1.3
No.1	Posts and Timbers	850	550	65	425	700	1.3
No.2		500	325	65	425	500	1.0
Western Cedars							
Select Structural		1150	675	65	425	850	1.0
No.1	Beams and Stringers	925	475	65	425	700	1.0
No.2		625	300	65	425	450	0.8
Select Structural	Posts and Timbers	1050	700	65	425	900	1.0
No.1		875	575	65	425	800	1.0
No.2		500	350	65	425	550	0.8